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The Institute of Vitreous Enamellers
The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

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Works Safety in Wartime

Generally speaking, there is but little need of any campaign to instil into the mind of the really skilled worker the necessity for safety first in its larger aspect; yet, because there are grave inherent risks in many trades, such as in steelmaking, for example, the melters and their type are apt to overlook minor injuries. Because of the relative prevalence of such injuries, the effect upon the national industrial output is of great importance. The unskilled entrant to industry, a familiar figure in wartime, is infinitely more prone to accident. These are two major contributory factors to loss in output, and wisdom has been shown by the Ministry of Labour and National Service by sponsoring through the Factory Department officers the campaign for accident reduction and education for safety.

In this work, the experience and organisation of the National Safety First Association is to be utilised to the full. Mr. Ernest Bevin, the Minister of Labour and National Service, in a foreword to a pamphlet announcing this development, has addressed himself to employers of labour in the following message:—

"In the country's drive for victory production is of paramount importance and anything that can be done to prevent dislocation of factory working is worth while. Accidents cause loss of time to the individual worker, but the loss of production is increased by the lost time of other people in attending to the injured and in the general upset caused in the workshop. Regarding an injured person solely as a producer, accidents are serious, but I have also in mind the suffering and depression that comes to the injured person, a matter that cannot be given a price.

"It is the duty of the Factory Department of this Ministry to help industry to deal with the prevention of accidents, but the ultimate success of any scheme rests with the management of individual firms, acting in co-operation with their workpeople, through their putting into operation the preventive measures that are advised. I am glad to have the service and help of the National Safety First Association, who have had nearly twenty-five years' experience of the methods by which progressive firms reduce their accident rates. This pamphlet outlines a special scheme, and I must have the co-operation of industry in making the best use of it. If the scheme succeeds in preventing even 1 per cent. of the accidents now occurring in industry, loss of production will be avoided and the money cost amply covered.

"The country recognises that the workpeople are in the front line. The value of the industrial worker is too great to have him or her laid aside, even for a day; so any hints for the prevention of accidents should be treated not as offering a safety funk hole, but as a real help towards keeping up that production which is so necessary to bring us to victory. Remember—accidents in factories are a bonus for the enemy."

The pamphlet to which Mr. Bevin refers details the nature of the services to be given, but for their continuation it is stressed that there must be a complete and whole-hearted co-operation between the employers and workpeople to achieve the ends sought. It naturally constitutes the first item to be distributed free under the new scheme, and indicates how a works employing up to 400 people will be regarded as a unit of service; up to 1,000, two units, and for each additional 1,000 or part of a thousand one more unit. According to its size each works will receive monthly a supply of 30 in. by 20 in. posters in sufficient quantity for replacement weekly. This constant change is essential, because it takes but a very short time for the posters to become merged into the general aspect of the shop, and pass unnoticed. The posters are to be of two types; the first is designed to increase the general awareness as to the causation of accidents, and the second will make propaganda for the proper use of the protective equipment provided and the first-aid services available.

There is also to be a free distribution of the monthly publication, the Industrial Safety Bulletin. We have invariably found this pamphlet to be of a helpful and well-balanced character. It is essentially practical, and never does it, like some of the earlier safety-first posters, descend to the maudlin.

Finally, supplies of four pamphlets are to be made available for distribution amongst the workers. The four chosen are: "We don't want to lose you, so . . .", "Workers' Safety Code"; "Blood Poisoning," and "Foreman's Leaflet." The first is specially written for new entrants to industry, and the second is meant for distribution a few weeks after the beginner has settled down to factory life. "Blood Poisoning" has been written by a doctor, bearing in mind that safety rules are more consistently followed when the reasons for their existence are better understood. A feature of the last pamphlet is the prevention of accidents amongst new workers and youngsters.

The pamphlet then sets out an outline of a works safety organisation, boiling the subject down to six paragraphs. In them are given all the essentials upon which any intelligent works manager can construct a successful scheme. It is pleasing to see that Part III of the pamphlet is devoted to first aid, as minor cuts and

(*Continued on page* 314.)

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

More Aspects of Reconstruction

SIR,—The leading article "Aspects of Reconstruction" in the JOURNAL of October 24 touches upon a subject of great interest to the present writer—the construction and reconstruction of the foundry industry. In any consideration of this subject it is necessary to remember that the industry falls into two divisions—unfortunately with an obscure line of demarcation—namely, "attached" and "independent" foundries, and that the problem of reconstruction can be dealt with in two stages—"commercial" and "technical."

When considering any possible simplification or reconstruction from the commercial point of view, the greatest difficulties would appear to arise from the position of attached foundries. This phrase is used broadly to describe those many foundries which are but single departments of larger engineering concerns and whose production is mainly absorbed by other departments of the parent undertaking. That they do, especially in periods of trade depression, encroach upon the domain of the independent foundries is well known and to a certain extent justifiably resented. It is suggested, however, that so far as the commercial category of the industry is concerned, any complications which might arise due to an attempted classification of such foundries should be absorbed within the undertakings themselves, and should not be permitted to complicate any clear divisions which might otherwise be made in the trade, employers' or employees' organisations.

The suggestion of initiating an overriding organisation would very probably involve the introduction of a complicated and possibly inefficient system of direction, and as an alternative it might be found more manageable—although perhaps more difficult of attainment—if it were possible to absorb existing local associations into one, and to reconstruct the local and specialised associations as branches, in much the same way as the Institute of British Foundrymen has branches.

Whatever the solution may be, it has become apparent that one is necessary; for it will be recalled that at the commencement of the present war, when the industry sought to co-operate with a Government department, it found itself in the unfortunate position of having no central organisation which could properly represent its many fields.

The diverse nature of the products of the foundry industry, and the tendency for the manufacture of the various classes of these products to centre in some particular geographical locality, have no doubt, to some extent, been the cause of the formation of so many local and/or specialised associations. These factors do not, however, justify the continuance of the present system.

Turning to the technical side of this problem, one discovers an even greater lack of co-ordination, and many more difficult problems to which THE FOUNDRY TRADE JOURNAL amongst other competent authorities has frequently directed attention. The impossibility of confining the practical applications of scientific developments to any particular sphere requires a much broader outlook to be taken of the technical organisation of the foundry industry than was necessary when considering the commercial aspect.

Such existing organisations as the Institute of British Foundrymen, the Iron and Steel Institute, the Institute of Metals, the British Non-Ferrous Metals Research Association and the British Cast Iron Research Association are familiar to all engaged in the industry. There are also the Metallurgical Department of the National Physical Laboratory and the highly specialised organisations, mainly associated with the non-ferrous industry, dealing with copper, tin, nickel, lead, etc., which must also be included in any system of unification. It is thought also that the results of work undertaken in the research departments of some of the larger foundries could be disseminated much more readily with the establishment of a central technical association.

Each organisation is attempting to place before its respective members details of the latest technical developments in the metallurgical field. These institutions and associations cover, of course, a much wider field than that of the foundry industry, but it is submitted that a very high percentage of the work undertaken by each is directly applicable to that industry and a knowledge of it is required by all foundry metallurgists for the successful prosecution of their several tasks.

Is it logical or economical, therefore, for these organisations to continue to function independently of each other? Would not greater benefit be gained by industry if some system of close co-operation, or even amalgamation, were undertaken by those concerned? If, as the article to which reference was made at the outset suggests, it should be unnecessary for the employer to subscribe to more than one employers' association, why should it be necessary for the metallurgist to subscribe to more than one technical association?

It is realised that the work of the many professional engineering and chemical institutions overlaps with that carried out by those more closely connected with metallurgy, but it would clearly be impracticable to link all those organisations which have some more remote interest in the foundry industry.

An important consideration, to some extent peculiar to the foundry industry, is the important part played by the skilled foundryman and the increasing interest which he is displaying at least in the broad outlines of the scientific principles of what to him is still largely an art. It is to the credit of the Institute of British Foundrymen that it has always remembered and respected this factor, which will play a most important part in the continued progress of the industry.

These are but scattered thoughts upon an extremely complex and extensive subject, but they may serve in some small measure to sustain the interest of those more competent to deal with this situation.—Yours, etc.,

CASSITERITE.

Notes from the Branches

Lincoln Section.—A well-attended meeting of the Lincoln Section of the Institute of British Foundrymen was held on November 2. This was the first of a series of informal social meetings of the Section. A lively discussion on wartime problems in the foundry took place, followed by tea. A similar meeting will take place on November 30.

"The Nickel Bulletin"

The "Nickel Bulletin" for September and October contains a number of abstracts of topical interest. Subjects dealt with in some detail include age-hardening, machinability and cutting-fluid recommendations, core materials for inductance coils, permanent-magnet materials, carbon diffusion in nickel steels, and recent work on the austenitic nickel-chromium steels. Copies may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

Random Shots

"See Naples and dive" has been suggested as a modern adaptation of the old phrase, "See Naples and die." There is another phrase of the same calibre that the R.A.F. look like translating into practice and proving the veracity thereof before long. It is the age-long saying that "All roads lead to Rome."

* * *

It has been said that Hitler is pushing the world back into the middle ages. The man who has the foresight to buy a pair of silk stockings now for his wife and sees her pleasure when he presents them to her on Christmas Day, will realise how feasible might be the legend that the happiest day in the life of Queen Elizabeth, was the one on which she received a gift of silk stockings from the "inventor."

* * *

"This is a B war, if ever there was one" is another phrase one frequently hears (especially from the lips of the sergeant-major when he has wakened up with a liver); and how true that is when one stops to consider how many of its household words begin with B, as compared with the last war! There is the black-out, the blitz and the barrage, not to mention the balloons and the bombs.

* * *

Listeners-in to the six o'clock news last Friday evening would have heard retold a story which appeared in this column two or three weeks ago. It was the one about the prisoner-of-war in Germany who finished his letter by saying "and especially tell it to the marines." It is flattering to think that what "Marksman" thinks to-day the B.B.C. announces to-morrow!

* * *

The crossword clue of the week is from the "Times," and is of special interest because of its foundry reference.

Clue.—The iron worker fishes.

Answer.—Smelts.

* * *

Incidentally, the French seem to be particularly fond of mixing up their fishing with their foundry work. A lump of pig-iron, for instance, in France becomes *un saumon* (salmon), whilst mottled iron is *fonte truitée* (trouted iron). No doubt in the old days of hammer-pond practice the French ironworker, always with a keen eye towards catching something good for dinner, combined a little private fishing with his work. Casting a net whilst casting a pig trough, as 'twere!

* * *

There was at least one other clue of merit in this week's puzzles. "One who is taken in and done for" was the clue, and anyone who has suffered in this direction will jump to the answer at once: Lodger.

"MARKSMAN."

Works Safety in Wartime

(*Continued from page* 313.)

injuries are such a prolific source of loss of time due to the incidence of sepsis. There is still need for many of the smaller concerns to make better provision for the early treatment of minor injuries. Finally, we suggest that those responsible for safety first in each works should invite where possible, from a neighbouring concern, the corresponding official to pay an informal visit, with the object of benefiting from the adage "the onlooker sees most of the game." A second adage—"familiarity breeds contempt"—is just as likely to cause mental myopia amongst safety-first officers as with any other section of the community.

Foundry Difficulties in Wartime

WEST RIDING FOUNDRYMEN'S INFORMAL DISCUSSION

Following the presidential address by Mr. H. A. MacColl, B.Sc. (which was printed in our October 24 issue), the West Riding of Yorkshire Branch of the Institute of British Foundrymen devoted the opening meeting of the new session to an informal exchange of ideas on overcoming wartime difficulties in foundry practice.

MR. H. FORREST (Past-President), opening the discussion, pointed out that if by consultation members could help one another in means of overcoming any of the problems that might arise in wartime, it would be to the good of themselves, the industry and the national effort. One of the chief questions of the moment, he supposed, was to avoid trouble about the black-out whilst still maintaining production. Ventilation, cupola glare, emergency lighting, etc., involved problems which must have caused worry and no little expense last winter, and now those problems arose again with an intensified stringency. There was the question of how to handle the cupola which was working when an alert came in the dark hours—whether to damp it down, open the tuyeres or take other action. A good deal would depend on the state of work at the time of the alert and on the duration of the alert, but it was well to take precautions in advance in preparation for the worst. If a cupola was left with the slag hole closed, the tuyeres closed and the fan off, who was to know whether somebody might disturb the arrangement and start trouble?

There was also the question of coke, and the constant re-use of scrap, which during the last war brought about the defect of internal chill—especially in Germany—and which, as older members would recall, was very troublesome during the big coal strike of twenty years ago.

There was also a problem in the supply of labour for foundries, though admittedly labour distribution was being dealt with better than during the 1914-18 war, when much female labour was in use. Mr. Blakiston, when referring to the President's address, had spoken of women in foundry work to-day, especially in core making. Personal experience entirely agreed with his suggestion that for that class of work the women were superior. He had, indeed, often wondered why the foundry industry did not make more use of female labour—though it would perhaps be as well to have them separately housed. He had seen them make very large cores and it was only a question of adequate training. There was also the question of hours of working and the provision of rest periods in these busy days, which must certainly be given adequate attention when employing women. One way of meeting this might be to have all the people working six days continuously and then a day off, but that involved having the plant idle one day per week. A better way, perhaps, was to work in overlapping shifts covering five days. That meant more personnel but it enabled the plant to be kept going seven days per week and the maximum output to be maintained.

Female Core Makers

MR. J. TIMBRELL, SEN., said that there were certain foundries now which did not employ any male labour at all in core-making work and which found female labour a distinct success. Where cores were too big and heavy for girls they were cut up, and it had solved a major problem at a time when labour was even less difficult to get than now. It might not be possible to introduce female labour in all foundries, but where it could be done it was undoubtedly advantageous. One of the factors that made for easy core-making was the use of sea sand, which the girls could handle better than naturally-bonded sands. The advantage of girl labour was that they would carry out their instructions without questioning. Girls also would assemble jigs and gauges and check them and hold them to standard quite well. On the other hand, if female labour was employed it was necessary to have a supervisor, and various other factors were involved which did not necessarily apply to male labour.

In answer to Mr. W. G. Thornton, MR. FORREST said the ordinary working week for female labour was 48 hours—44 hours if under 16 years of age; but by getting permission for special necessity the adults could be worked up to 53 hours.

Fire Watchers and Spotters

MR. THORNTON mentioned the new Government Order for fire watchers and aircraft spotters in relation to small foundries. There seemed to the speaker to be some laxity of ruling as to the extent to which both these forms of appointment must be made, as distinct from big firms. In his own case, said Mr. Thornton, he had arranged for night-shift work in which there would always be somebody as watcher and spotter, but the spotter scheme seemed to be more or less suspended for the moment, pending the special instructional classes being held.

MR. F. K. NEATH, B.Sc., said that according to the Order there should be fire watchers throughout the 24 hrs., but he understood there might be some modification of this requirement during working hours. The requirement for aircraft spotters, he believed, was more especially applicable when a firm was working during an alert period.

Glare Elimination

MR. THORNTON, referring to light from furnaces during the dark hours, said that up to now his own idea had been to shut down and cover the stack to eliminate glare.

MR. NEATH said he understood that any foundry working in the dark hours must have a proper anti-glare arrangement. Many foundries tried to finish work involving glare before darkness, but as winter days became shorter that might not be possible, and there would also be the question of glare on days of bad weather when darkness came long before the official black-out time. One recommendation which had come to his notice was to throw on a mixture of sand and limestone, but that seemed rather to be asking for trouble in the cupola. His personal notion was to throw two or three feet of coke on. It would damp it down, and the material could afterwards be burned away.

The PRESIDENT said that Mr. Neath's point about dark winter days, before black-out time, was an important one. People who allowed glare in those dark afternoons would be a public menace, because the enemy were not going to regulate their activities by official black-out times.

MR. BLAKISTON suggested shutting off the cupola and putting anti-glare corrugated sheeting over the furnace with the blast off.

MR. FORREST asked if, when working, there would be time to do that in case of an alert.

MR. BLAKISTON said his staff had been thoroughly trained to do it quickly.

The PRESIDENT reminded them that there was no certainty of any time lag from the warning to an actual raid. A raid was liable to happen any time even before the sirens sound, and it might be on a dark November afternoon long before official black-out time.

MR. J. TIMBRELL said there was a simple damping material which could be actuated by a wire.

The PRESIDENT pointed out that this was satisfactory if the foundry was to shut down completely, but it was undesirable to stop working unless conditions were serious. What was required was an effective and quick anti-glare method which would be used but which enabled the management to keep the blast on the furnace.

MR. NEATH said he could show members one which was working all last winter and was quite satisfactory, but it was a rather cumbersome affair. To his mind, little bonnet spark arresters were not effective.

MR. BLAKISTON said much depended on the cupola itself, as some were very hot at the top and difficult to deal with in this manner.

MR. FORREST suggested, as a means to glare elimination, the cutting of some air holes in the brickwork immediately above the charging hole, thereby admitting air to burn low down in the stack and stop the inflammable gas burning at the top of the cupola; but there must be a cowl, and if there was much heat it was not liable to last very long.

MR. BLAKISTON said the trouble about black-out precautions was that one could reach a point at which the foundry became so intolerably hot that it paid to work only in daylight hours.

Inverse Chill Elimination

MR. NEATH said in regard to the problem of inverse chill—mentioned by Mr. Forrest in his opening remarks—general opinion was that if there was a fair amount of manganese present it would overcome the difficulty. Many writers during the past twenty years had shown that if the manganese was kept at, say, 1.6 or 1.7 per cent. one should be able to overcome the inverse chill difficulty. Moreover there were the developments in desulphurisation by soda ash.

MR. FORREST said that if desulphurising in the ladle, it should be of the tea-pot type. Many were inclined to assume all their troubles were due to too high a sulphur content in the iron, but actually they should use hotter iron. The tea-pot spout on the ladle was necessary to prevent slag inclusion in the metal.

MR. BLAKISTON said that personal experience of soda ash was that it was very satisfactory in effect, but inclined to be dangerous if put through the ladle; it was preferable to incorporate it with the charge. He agreed that if manganese was kept to about 1 per cent. one could avoid trouble.

Phosphorus Reduction

MR. NEATH, speaking of phosphorus reduction, recalled that one founder used to make his cylinder blocks with iron running between 0.6 and 0.7 per cent.

MR. THORNTON said that was satisfactory with small sections, but it was perhaps not so applicable in general ironfoundries, where thick sections were encountered.

MR. NEATH pointed out that it was necessary to reduce the total carbon, and steel additions were called for..

MR. FORREST said that, assuming a fairly high phosphorus iron, carrying 3 per cent. silicon, was available, and steel were added to it, it yielded two extremes of a type liable to give trouble. It appeared preferable to run a fairly high percentage of pig-iron, add about 10 per cent. of steel, and reduce the scrap content of the charge. By avoiding the use of heavy percentages of steel and making up with a fair percentage of pig-iron, which somewhat reduced the fluidity of the iron, fair success would be achieved. The idea of getting down to 0.6

(*Continued on page* 316.)

New Portable Conveyor

GRIT-PROOF IDLERS AND INVERTED TROUGHING

There is little doubt that much time and effort are still being wasted in shovelling fuel and other materials from the ground into lorries or even into railway wagons, where a portable conveyor would quickly pay for itself. Actually, of course, there are many portable conveyors already at work, and a wide field exists for their further application. Mavor & Coulson, Limited, Glasgow, have been making portable conveyors for many years, and recently they have produced a new design, economical of steel, light to move, simple and inexpensive.

This new portable conveyor is exceptionally convenient to use. The wedge-shaped end helps loading, by enabling the conveyor to be pushed into loose material, some of which thereupon rolls on to the belt or can be pulled down on to it. The shovelling on to the belt is greatly aided by the lowness of the receiving end. If required, a removable hopper can be supplied to collect and guide the material on to the belt. The belt is either 18 or 24 in. wide; its speed is chosen to suit the work to be done, but, generally speaking, the peak capacity provided when handling coal is 40 tons an hour for the 18-in. belt or 60 tons for the 24-in.

The length of the conveyor is either 30 or 48 ft. The gradient depends on the material to be handled, but for coal the greatest height of clear delivery is 9 ft. 4 in. for the shorter conveyor and 15 ft. for the longer. The jib can be either fixed or hinged; when hinged, the least height of delivery is 5 ft. 4 in. for the shorter conveyor and 9 ft. 6 in. for the longer. The hinged jib allows the height of fall to be kept small and breakage to be therefore the least possible. Moving the jib up or down is extremely easy, and is effected through a worm gear, a rope drum, and two ropes, each passed round a pulley on the jib to double the purchase and halve the effort. A rigging screw at the end of one rope is used to equalise the tension and give uniform support to the jib.

The motor is a 3- to 4-h.p. or a 5-h.p. petrol engine, or a 3- or 5-h.p. electric motor, according to the capacity, height of lift and power supply chosen. The drive is taken to the head pulley, the most effective point at which to drive the belt, by two roller chains, which give a double speed reduction and allow the belt speed to be altered by changing a sprocket. The countershaft is co-axial with the hinge of the jib, so that moving the jib does not alter the tension of either chain.

The road wheels are large in diameter, to ride easily over the ground. The loader is kept light by the "hopper-cooled" engine, which has no heavy water tank, and by the use of M. & C. inverted troughing as an element of the structure. Besides its structural rôle, the troughing plays another important part in guarding the belt. The grit-proof idlers are 5 in. dia. and mounted on low-friction ball bearings. The bearings are completely protected from rain or dust, firstly by the solid upper end of the inclined idlers, which are not pierced by projecting spindles down which dirt would tend to creep; and, secondly, by labyrinth grease seals which have been proved to catch every particle of grit before it can approach any bearing. The seals and the reserve of lubricant for the bearings are replenished at long intervals through a grease nipple on each idler bracket. The idlers therefore continue to carry the belt with lowest possible friction for many years. All the idler brackets can be adjusted for "training" the belt to run central. The edges of the belt are free from contact with guide idlers or plates, and the belt has long life.

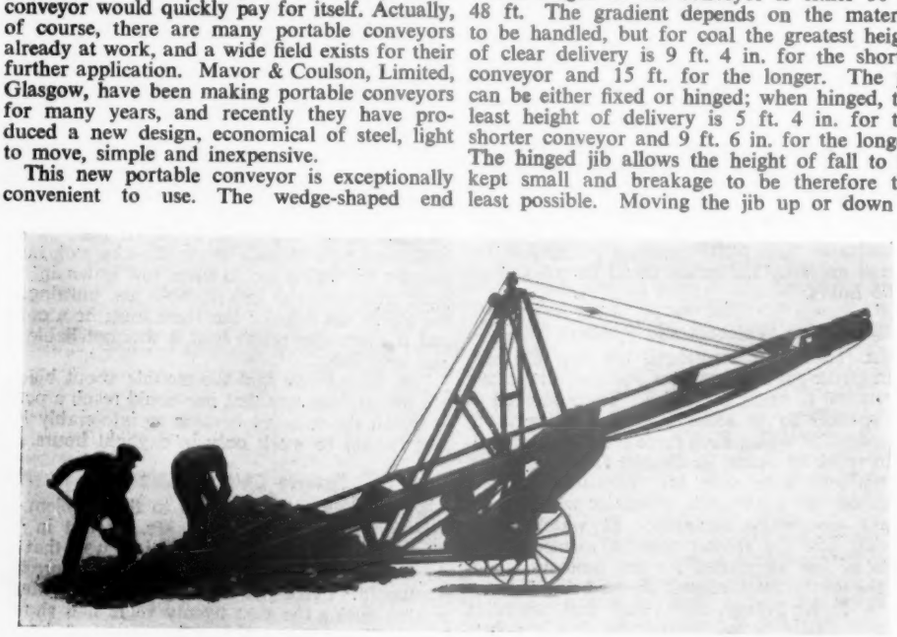

FIG. 1.—THE 30-FOOT M. & C. CONVEYOR WITH HINGED JIB FULLY RAISED.

FIG. 2.—ROPE WINCH AND ENGINE.

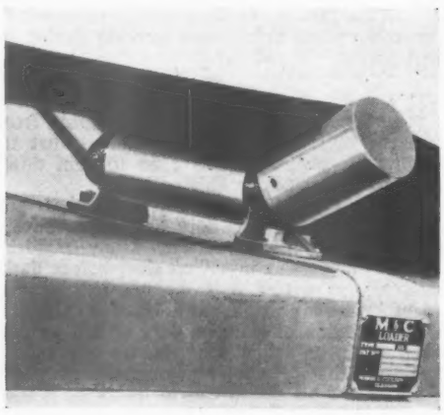

FIG. 3.—M. & C. GRIT-PROOF BALL-BEARING IDLERS MOUNTED ON THE PROTECTIVE INVERTED TROUGHING.

Temperature of Molten Steel

The feasibility of measuring the temperature of molten steel in an O.H. furnace, investigated by S. FORNANDER and T. OMBERG in "Jernkontorets Annaler," depends on the characteristics of the thermo-couple used. A water-cooled tungsten-molybdenum couple in a Pythagoras sheath gives satisfactory values up to a temperature of 1,700 deg., while the readings of a platinum/platinum-rhodium couple are not reproducible. Graphite-SiC was found physically unsuitable. It was observed, moreover, that the working temperature of a basic O.H. furnace is not constant and may vary over a range of 170 deg., even with batches of the same composition. There is no relationship between the working temperature and the "heat content," as judged arbitrarily by the smelter, or the oxygen and manganese values of the charge. As the carbon is increased, the temperature of the furnace tends to fall, while the working temperature does not seem to affect the properties of the steel produced.

Foundry Difficulties in Wartime

(*Continued from page* 315.)

per cent. P was not helpful, and it was better to work with 1 per cent. and add 10 per cent. steel, using a high proportion of pig.

MR. NUTTON said his foundry manufactured very heavy castings which demanded a really dense iron. The best method he had found for making dense castings was to reduce the carbon content, as it yielded a high-tensile iron associated with adequate fluidity. He regarded excessive manganese with disfavour.

MR. THORNTON, reverting to the matter of raid precautions, suggested the advisability not only of making proper black-out provisions, but also of laying in a stock of window glass, felting sheets, asbestos, etc., for replacement work in case the foundry had a bomb fall on or near it. One could get permits to buy these things for quick replacement, but it was better, if possible, to have some materials in stock so work could be resumed with minimum delay.

On the motion of MR. NEATH, seconded by MR. D. JEPSON, M.Sc. (Mr. MacColl's successor at Bradford Technical College), the meeting expressed thanks to Mr. Forrest for opening the evening's discussion.

MR. JEPSON said he had greatly enjoyed his first visit to the West Riding Branch of the Institute, and hoped he might emulate his predecessor (the President) in maintaining his personal interest and the contact between the College and the Branch.

Institution of Automobile Engineers

WORK OF THE RESEARCH DEPARTMENT

The work of the Research Department of the Institution of Automobile Engineers is controlled by the Automobile Research Committee, which consists of representatives from the Institution, from affiliated members, and from Government Departments. The research work undertaken is for the benefit of the automobile and allied industries, and is concerned mainly with those problems which are best investigated by co-operative means. The results of the investigations are in the first instance circulated confidentially to the members, and later released for general publication.

The work of the Committee is financed by grants from the Department of Scientific and Industrial Research, and by contributions from affiliated members and from the Society of Motor Manufacturers and Traders, Limited. Any British company or person engaged in the manufacture or development in Great Britain or Northern Ireland of motor vehicles, of parts or materials, accessories or components to be incorporated therein, or any fleet operator approved by the Council is eligible for election.

The Research Department consists of general offices, library, chemical and physical laboratories, workshop and general test laboratories where experimental work on vehicles, engines and individual components may be carried out with modern equipment and under controlled conditions.

In addition, the Research Department abstracts and classifies technical information from a large number of English and foreign publications. These abstracts are circulated in loose-leaf form to affiliated members, to whom the originals are sent on loan when desired. The resources of the library and its connections with other technical libraries are available to assist members in finding technical information on any problem in which they are interested.

A number of reports dealing with the results of some of the experimental work carried out in the past few years have now been released for general publication, and cover such subjects as engine bearing temperatures; brake squeak; fuel economy, and the effect of hot lubricating oils on the fatigue strength of bearing metals. The following notes refer to the main problems at present under investigation, with a brief description of the apparatus employed.

Chassis Laboratory

Testing of De-Aerating Devices.—The continued circulation of aerated oil through an engine may result in serious damage to certain highly-loaded parts due to the reduction in the effective viscosity of the lubricant. Particularly is this the case with aero engines, and devices are in current use for removing some, if not all, of the air from the oil. The rig now being used has been designed for testing full-size de-aerators. Broadly, the principal object of the plant is to supply a sufficient quantity of aerated oil to enable the effectiveness of the de-aerator under test to be determined over the range of conditions likely to be encountered in practice. The capacity of the plant is such that full-scale aero-engine conditions can be reproduced in the laboratory.

To enable large quantities of air to be introduced into the oil, two pumps are used, the first priming the second, atmospheric air being admitted on the suction side of the latter through a variable cock. The air flow is measured by means of a bellows-type gas meter, the degree of aeration being determined from the relative flows of air and oil. Provision is also made for varying the oil flow and the temperature and pressure of the oil. The aerated oil is led, for inspection purposes, through a glass tube to the de-aerator under test.

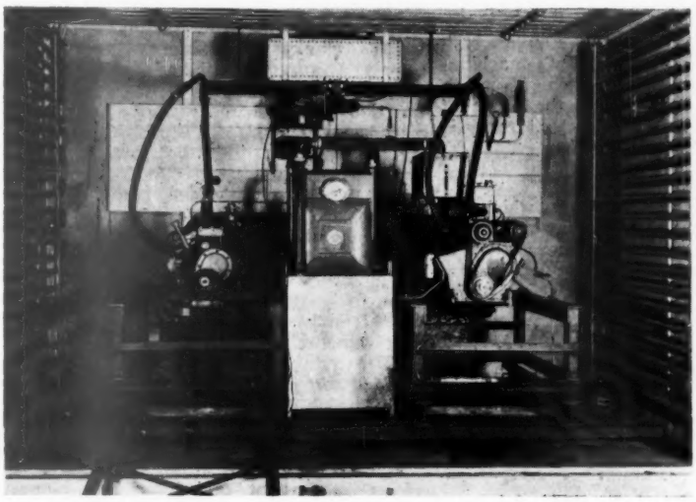

FIG. 1.—VIEW OF INTERIOR OF THE COLD ROOM.

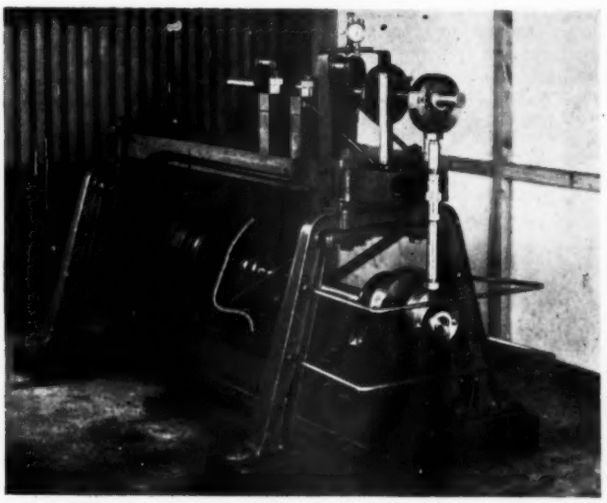

FIG. 2.—ONE OF THE CRANKSHAFT TESTING MACHINES.

Engine Laboratory

Engine Performance on Producer Gas.—The object of this research has been to study systematically the power loss resulting from the use of producer gas in a converted petrol engine. The gas is produced from anthracite in an "Emergency" dry-type producer, and to simulate road conditions the producer is mounted on a "bumping" rig and is cooled by an air blast. In addition, mains water is circulated through the jacket to ensure adequate cooling. The gas from the producer is passed through a filter packed with sisal tow. The engine, a six-cylinder, side-valve unit of 3½ litres capacity, is of a type commonly used in trucks up to 3 tons capacity. The engine is connected to an electric dynamometer, which enables it to be motored, for the measurement of frictional losses, as well as to be run under power. This also facilitates starting.

Orifice type flowmeters, for measuring independently the gas and air flows to the engine, are interposed in the pipeline between the producer and the engine, the flow in both cases being controlled by butterfly throttles downstream from the meters. On a panel immediately above the flowmeters are mounted various gauges for measuring the pressure drop across the orifices and the pressure and temperature at various points in the producer-engine circuit.

Immediately beyond the throttles, the gas and air are fed into a common pipe, which also acts as a mixing chamber, connected to one branch of a tee-piece mounted on the engine intake manifold. The other branch of the tee-piece carries the normal petrol carburetter enclosed in an airtight box. The air flow to the carburetter is measured by means of a separate orifice type flowmeter connected to this box. To prevent air leaks, which cannot be measured, the control rod to the carburetter throttle operates through a closely fitting rubber bellows. The general arrangement of the controls enables the engine to be run exclusively on producer gas, or on producer gas with varying degrees of petrol assistance. Provision has also been made for manual control of the ignition timing.

In addition to studying the performance of the standard engine on producer gas, means for restoring the power loss have been investigated. These have included raising the compression ratio, increasing the calorific value of the mixture by introducing various quantities of petrol and by steam injection in the producer.

Scuffing of Piston Rings.—Scuffing of piston rings can occur both under idling conditions and at high loads and temperatures. The object of the present investigation is to study systematically the factors controlling scuffing of piston rings and methods of inhibiting scuffing. The work is being carried out on a single-cylinder, liquid-cooled unit coupled to a hydraulic dynamometer. The temperature of the jackets is closely controlled by using ethylene glycol in conjunction with a cooler. The supply of lubricant to the cylinder walls can also be controlled. So far, the experimental work has been directed towards establishing a satisfactory testing technique. It is proposed to examine the relative merits of various surface finishes and treatments for piston rings, and a selection of specially prepared rings is on view.

Effect of Aerated Oil on the Behaviour of Engine Bearings.—Aeration of the lubricant in an engine results from various causes, and in the present investigation the effect of aerated

oil on the behaviour of a bearing is being studied. For this purpose, a production connecting rod and big-end bearing have been mounted on a shaft connected to a swinging field dynamometer. A uni-directional load is applied to the bearing by a system of levers and the shaft is rotated, any change in bearing friction being measured by means of the dynamometer. The oil circuit includes two pumps run independently. Air is introduced into the lubricant at the second pump through a variable cock, the first pump merely serving to prime the second pump under all conditions. The quantity of air is measured, and when related to the oil flow, the degree of aeration of the lubricant can be determined. The aerated oil is fed to the rod half of the bearing and, after passing through the bearing, is collected, de-aerated and recirculated. The oil flow is determined by weighing, a small tank complete with a heater being mounted on a balance alongside the machine for this purpose.

General Laboratory

Overheating of Tyres and Brakes on Buses.—On buses operated under severe city service conditions, particularly in hilly districts, trouble has been experienced owing to excessive temperatures reached on tyres and inner tubes, resulting from the transmission of heat from the brakedrums. The apparatus installed in the laboratory has been used for an examination of heat transmission from a brakedrum to a wheel rim and tyre, and for a study of various design features and of possible methods for reducing both brakedrum and rim temperatures. The wheels on one side are free to rotate while being subjected to a continuous braking force applied through the normal brake rod mechanism, the braking load being measured on a spring balance. The wheels at the other end of the axle are prevented from rotating by a torque arm and spring balance, the latter indicating the braking torque imposed on the rotating wheels and transmitted through the differential.

Measurement of the temperature of the various parts is obtained by means of copper-constantan thermocouples. For parts which are rotating the leads are soldered to pairs of copper and constantan slip-rings. Selection of any particular couple the temperature of which it is desired to record is obtained by sliding a pair of copper and constantan brushes on to the appropriate pair of slip-rings, the slide for the brushes being marked with a series of numbers corresponding to the various thermocouples. The brushes are connected through copper and constantan leads to a potentiometer. Temperature measurements are made in the wheel rim, brakedrum and brake lining.

Cold Room.—The equipment illustrated in Fig. 1 has been designed with a view to enabling a detailed study to be made of the factors affecting the starting performance of engines at low temperatures. The cold room, which operates at thermostatically controlled temperatures down to −25 deg. C., can accommodate two engines. These are mounted on test beds which are run into the cold room on a movable ramp. A burette is used for measuring fuel consumption, leads being taken to each engine position, and the pressure at which fuel is delivered from the burette may be adjusted to correspond to any fuel pump pressure. For the measurement of air consumption, a gas meter of the bellows type is mounted on an air box which serves to damp out the pulsations occurring at low engine speeds. A large-capacity tank containing a low freezing-point coolant is mounted above the engines and, by means of an electrically-driven impeller and a system of three-way cocks, the coolant may be circulated through either engine. This arrangement allows prolonged motoring tests to be run without excessive temperature rise due to engine friction. Thermocouples are used for measuring fuel and coolant temperatures, and the temperatures of the cylinders and sump of each engine, the thermocouple wires being led to a millivoltmeter and switch outside the cold room.

Outside the cold room, a swinging field dynamometer is used for motoring the engines through a 10:1 reduction gear, and a free wheel to a shaft which passes through the cold room wall to the test engine. This equipment provides a range of motoring speeds of 10 to 200 r.p.m., while the free wheel permits the engine to accelerate when starting. The dynamometer can be moved to either engine position, and the swinging field is automatically balanced. Equipment is also provided for obtaining a continuous record of engine rotation during a test.

Gear Testing Machines.—Two machines are in use for work on gear durability, the object of the investigation being to study the effect of profile shape and material of the gears on surface failure, using a wide range of lubricants. In these machines, two pairs of gears are run in the form of a closed train, an initial load on the gears being introduced when the machine is at rest by uncoupling the flanges of the divided shaft, twisting them relatively and bolting together again. The driving motor supplies only the frictional and other losses. Both machines incorporate an oil-circulating system in which the temperature and quantity of the lubricant can be controlled. The Sykes involute tester is used for measuring the gear profiles.

Fatigue Strength and Crankshafts

Bending Fatigue.—Three machines, which are similar in principle but differ in constructional detail, are used to ascertain the fatigue strength of typical full-size crankshafts under known alternating bending moments. One of these machines is shown in Fig. 2. The end throw of the crankshaft under test is fitted with an extension shaft, and the adjacent throw is bolted rigidly to a stiff platform. The end of the extension shaft is given a vertical reciprocating motion by means of an eccentric and connecting rod. The eccentric consists of a pin and sliding bar mounted on a face plate driven by an electric motor, the amount of eccentricity being adjustable to suit the required conditions of loading. To enable the crank to be loaded equally on either side of the no-load position, the connecting rod is adjustable in length. To calibrate the shaft for a given alternating bending moment, a dial gauge is fixed adjacent to a crank web under test and a loading platform is mounted on the end of the extension shaft, which is loaded statically with weights and the dial gauge readings noted. The weights and platform are then removed, the connecting rod is assembled and the eccentric adjusted to give a dial reading corresponding to the bending moment required for the test. When the crank web in the first throw is broken, the whole shaft is moved forward so that the next throw is free for test.

Durability and Wear of Bearings.—A machine is used for studying the durability and wear of small-scale bearings of different materials under various conditions. The machine is in the form of a dummy single-cylinder engine having a built-up crankshaft with a renewable crankpin, and is driven by an electric motor. The connecting rod has a solid-eyed big-end into which the bearing under test is inserted. Pistons of known weight are used so that, when the machine is running at a given speed, the alternating load on the bearing can be calculated. Lubricating oil is supplied to the bearing at a known pressure and rate, a separately-driven oil pump being used, while the supply tank is carried on scales. The temperature of the bearing is controlled by circulating hot or cold air

(*Continued in next column.*)

Locomotive Tyre Failures

MR. C. W. NEWBERRY'S Paper on locomotive tyre failures, presented to the Institution of Mechanical Engineers—a short abstract of which was given in our issue of March 7, 1940—has provoked a long and interesting discussion.

From the foundry angle a communication from MR. F. H. WILLIAMS, M.Sc. (assistant test engineer, Canadian National Railways), is of outstanding interest. The following is a quotation from his contribution, printed in the Institution's "Proceedings," vol. 143 (1940), No. 5:—

"He (Mr. Williams) found it instructive to compare locomotive tyre failures with those of passenger vehicles. The former were usually mounted on cast-steel, and the latter on cast-iron, wheel centres. Tyres failed from different causes in the two classes. The damping effect of cast iron was so much greater than that of steel that its adoption would modify the whole question of failures. Most locomotive tyre failures were due to fatigue cracks starting at the bore, and arising from minute defects. Failures of passenger vehicle tyres almost always began at the tread; the majority were due to thermal cracks arising from application of the brake blocks.

"Moreover, he himself had never seen an axle fail inside the wheel fit on a passenger or freight vehicle, if cast-iron wheels or wheel centres were used, though this had often occurred in locomotives, and he believed this was due to the use of cast iron in the former cases, as it tended to keep the stresses below the fatigue limits. He therefore suggested the use of a high-duty cast iron for locomotive wheel centres, as he felt it would eliminate one persistent type of failure. For existing steel centres, conditions could be improved by undercutting the axles to the extent of 0.003-0.005 in. for a width of about ½ in., just inside the wheel fit."

In his reply, MR. NEWBERRY made the following comments on Mr. Williams' contribution:—

"The many points raised by Mr. Williams provided a helpful comparison between Canadian and English experience, and he wondered whether, in view of the more extreme climatic conditions, Mr. Williams had been able to note a seasonal occurrence of fatigue failure. The reference to passenger vehicles was interesting because, in contrast with the Canadian National, carriage wheel centres on the London, Midland and Scottish Railway were of rolled steel with a tensile strength of 33 to 40 tons per sq. in.; and axle failures, while infrequent, had shown a tendency to occur just inside the press fit of the wheel. Carriage tyre defects tended to be confined to the tread and flange and to be similar to those of the Canadian National Railways. Though other important conditions might affect the issue, this suggested that the change to cast-iron centres had less effect on the tyre than on the axle.

(*Continued from previous column.*)

through the crankcase, the air circuit including a fan, an air heater and an oil trap.

Effect of Aerated Oil on Bearings.—The object of this investigation is to study the effect of aerated oil on the durability of bearings of various materials. The bearing testing machine is similar to that described above, and the test bearing is supplied with oil in which the degree of aeration is under control. The oil is circulated by two independently-driven pumps in series. Dry air is introduced into the circuit on the suction side of the second pump, priming being assured under all conditions by the first pump. The quantity of air introduced into the circuit is adjustable, and is measured by direct displacement. On the delivery side of the second pump the aerated oil is passed through a glass inspection chamber and thence to the bearing under test.

Casting Defects Common to Motor-Vehicle Grey Iron*

THEIR IDENTIFICATION, PROBABLE CAUSE AND CONTROL

By W. B. McFERRIN

Those who have been associated with the production of motor-vehicle grey-iron castings for the past 12 or 15 years have witnessed great strides in the reduction of variables in metal, moulding, core-making, materials and practice used. In an effort to meet competition and demand for greater durability and quality, the motor-vehicle manufacturer has called upon the foundry to produce castings of more intricate design with closer tolerances in all their physical and chemical characteristics.

The general trend in the motor-car foundries in the past few years, beside the installation of labour-saving and high-speed production equipment, has been to reduce the sizes of risers, runners, sprues and pouring basins to the minimum required to give sound castings. Castings are made under very closely controlled conditions, thereby increasing their casting yield by as much as 50 per cent. in some cases.

Ten years ago 35 to 50 per cent. casting yield was quite common. Now some of the foundries are obtaining yields as high as 65 to 75 per cent. and constantly striving to improve. This was made possible (1) by closely controlling pouring temperatures and metal composition; (2) by making a systematic study of gating and risering, thereby making use of all available flask space, as, for example, the grouping or "deadheading" of smaller castings around larger ones, where the two are poured from metal of the same composition, and (3) by closely controlling the conditioning of the sand, ramming of moulds, cores and their venting.

Some of the factors necessary for the production of good motor-vehicle grey iron castings may be stated as follow:—

(1) Adequate equipment properly staffed.
(2) Adequate supervision—progressive supervision that understands foundry problems and knows how to handle men and equipment.
(3) Metal: (*a*) Good quality of material for use in the mixing, melting and superheating processes; (*b*) complete knowledge of the chemical and physical properties of the materials used; (*c*) correct operation and control of the melting process, and (*d*) metal melted hot (1,535 to 1,620 deg. C. at spout), poured at proper temperature and rate.
(4) As near correct design of casting, pattern and construction of pattern equipment as possible.
(5) Proper mould construction of suitable materials, including consideration of cores, such as proper anchoring and venting.
(6) Proper core construction of suitable materials, including consideration of proper venting, anchoring and baking to prevent shifts and blows.
(7) Suitable cooling time.
(8) Proper cleaning operations.
(9) Thorough inspection.
(10) A complete, clear and concise set of records of each day's operation, correctly compiled and properly interpreted.

This Paper is presented with the hope that it will promote the classification of various defects common to grey iron castings, their correct identification and cause, thereby helping to clarify this important and complex problem. Casting defects common to motor-vehicle grey iron are dealt with under fifteen categories, each one of which carries a numbered heading.

1.—Shrinkage and Contraction Defects

Classification of Shrinkage Defects

Shrinkage defects may be classified under two general classifications:—

(1) The first class includes the common voids, draws or sponginess which are present as irregular shaped cavities, the interiors of which are lined with pine-tree-like crystals, metallurgically known as dendrites. These crystals, unless discoloured by gases, have the appearance of a new fracture. Defects of this kind are generally found near the centre of a heavy section or near a change in section thickness, and generally are completely hidden until after the casting is partially machined.

(2) The second class includes (*a*) the common "sinks" or "depressions," which make their appearance on the cope side of a heavy flat casting, and (*b*) open or closed pipes that appear on the cope side of heavy bosses, lugs, large bars, or columns cast with the longest side in the vertical plane. The common variation of the above is a "hot tear" or "shrinkage crack," generally appearing on the cope side of castings where a flange or rib joins a heavier section.

Probable Causes

It is beyond the scope of this Paper to take up the various methods of gating and risering that are used and the procedure followed in establishing the correct gating method for any production pattern or patterns. Therefore, it is intended to deal only with those shrinkage defects that occur occasionally during the year in production castings, due to one or more of the first two factors, given below, being out of balance. These defects are due to such factors as (1) composition; (2) pouring temperature and time; (3) design of casting, and (4) gating and risering.

Strictly speaking, these defects are caused by two distinct volume changes that are common to all metals when cooling from pouring temperature to and through the solidification range. These volume changes are (1) liquid shrinkage, in which shrinkage takes place in the volume of a metal while cooling from pouring temperature until it starts to solidify, and (2) solidification shrinkage, in which a change in volume takes place while the metal is cooling through the solidification range.

According to Saeger and Ash[2], Timmins,[3] Bolton,[4] and MacKenzie,[5] liquid shrinkage for all grey irons per degree temperature drop is approximately the same regardless of composition. This volume shrinkage is approximately 1.1 per cent. per 100 deg. C. decrease in temperature. Shrinkage defects from this source are generally found in castings that are poorly designed, such as those having isolated heavy sections in positions where it is impracticable to place gates, risers or other devices for replenishing the supply of molten metal or controlling the direction of solidification.

Volume change which takes place while metal is cooling through the solidification range is dependent upon composition, or, as expressed by MacKenzie,[5] upon "carbon equivalent." The carbon equivalent is equal to total carbon + 0.3 (silicon + phosphorus). This change varies from an expansion of 1.65 per cent. in hypereutectic cast iron to a contraction of 5.85 per cent. in low-carbon low-silicon irons.[2] The distribution of the effects of this volume change upon the casting is dependent upon the temperature gradient within the casting, which, in turn, is dependent upon pouring temperature and time, gating, risering and design.

This is one of the reasons why foundrymen prefer gating through thin sections into the heavy sections, thereby evening up the temperature gradient as much as possible and increasing the chances of feeding. However, if the temperature gradient is too large to be overcome by this method, then risers, shrink bobs or chills will have to be used to produce sound castings free from shrinkage defects.

Chills should be used only as a last resort on production castings because, if they are not correctly used, handled and properly cleaned before using, they will cause more trouble than they correct. Then, too, there is the added expense of replacement and the time lost due to the extra operations involved.

True Causes and Corrections

Shrinkage defects, as described under general classification No. 1, are caused from high carbon and silicon, or too high carbon in combination with high phosphorus, or high silicon for methods of gating, risering and sectional thickness (or design of casting). If it is necessary to use high phosphorus and silicon on account of fluidity and machinability, then carbon will have to be lowered to avoid sponginess, remembering that with lower total carbon, greater care must be taken in gating and risering to avoid sinking, piping or hot tears. It has been the writer's experience that if phosphorus is kept below 0.25 per cent., carbon and silicon can be varied over a much wider range without encountering shrinkage defects.

FIG. 1.—CASTING WHICH SHOWED DEFECTS IN THE BOSSES AND LUGS AT POINTS A, B AND C IF CARBON EQUIVALENT WAS NOT CONTROLLED.

Shrinkage defects as described under general classification No. 2 are caused from too low carbon which may or may not be associated with high silicon and high phosphorus, for method of gating and risering used. If it is found, due to specifications, that a casting must be poured from low-carbon metal, even though silicon might be high, risers, shrink bobs or possibly chills as a last resort may have to be used to prevent sinking or piping.

The casting in Fig. 1 has isolated bosses 1¼ in. thick and 3½ in. high, surrounded by metal ⅜ in. thick. This casting is made two to the mould with bosses A and B uppermost. Since it is cast from metal having a carbon equivalent range from 4.20 to 4.45, no risers are necessary for the gating arrangement used. However, if the composition was changed to give a carbon equivalent of 4.10, it was found that lug C and bosses A and B showed a depression in the centre of the top, becoming progressively deeper as the carbon equivalent was lowered. On the other hand, if the composition was changed

* Paper presented to the Chicago Convention of the American Foundrymen's Association. The author is foundry metallurgist, Cadillac Motor Car Division, General Motors Corporation, Detroit, Mich.

to give a carbon equivalent of 4.60, the castings showed signs of internal porosity at the junction of lug C and the curved wall of the casting.

Castings of the type shown in Fig. 2 are cast two to the mould, large end uppermost, from metal having a carbon equivalent range from 3.80 to 4.20. As long as the composition is maintained within that range, and provided the silicon does not exceed 2.40 per cent., the phosphorus 0.030 per cent., and the carbon 3.10 per cent., then the casting is perfectly sound; but, if carbon was below 3.10 per cent., a shrinkage defect appeared as a hot tear at point A, at the junction of flange B, whilst piping occurred in the lug at C in extreme cases.

The casting in Fig. 3 is approximately 2 in. thick, weighs approximately 60 lbs., and is gated to fill the mould in from 18 to 20 secs. This casting is made on the same production line with other castings that demand hot iron (higher than 1,425 deg. C.) to run. The majority of castings on this line are poured at temperatures from 1,455 to 1,510 deg. C. (Temperatures are measured with optical pyrometers which are checked against standard several times per week.)

It was found that 15 secs. was the minimum pouring time for the composition range required to give a casting of necessary physical properties. If pouring time was reduced below 15 secs., castings showed shrinkage defects in the form of "sinks" or "depressions" on the cope side, in the vicinity of gates, unless risers were used to feed castings. Risers are used only as a last resort. In fact, no riser or shrink bob is used on a single production casting in the shop. The pouring weights of the castings range from a few ounces up to approximately 500 lbs. This condition was made possible, first, by close co-operation between engineering and foundry staffs and, secondly, by closely controlling composition, pouring temperature and time, and making a systematic study of gating.

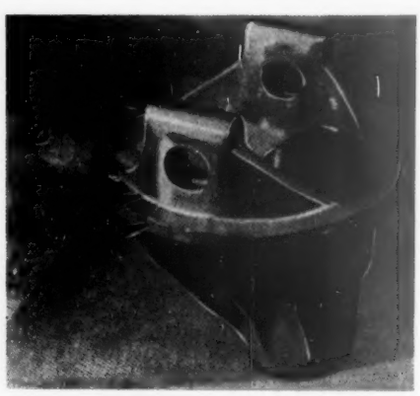

FIG. 2.—CASTING WHICH SHOWED DEFECTS IN THE FLANGE AND LUG, POINTS A, B AND C, IF THE CARBON EQUIVALENT WAS NOT CLOSELY CONTROLLED.

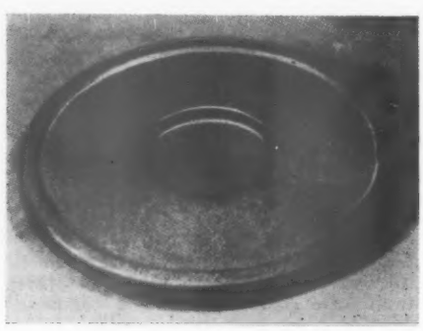

FIG. 3.—CASTING SUBJECT TO SINKS AND DEPRESSIONS IF POURING SPEED WAS NOT CLOSELY CONTROLLED.

The casting shown in Fig. 4 is cast with the crankcase uppermost, one to the mould, and has a pouring weight of approximately 475 lbs., from metal having a carbon equivalent range from 3.80 to 4.20. The carbon equivalent is maintained as near to 4.00 as possible to give a Brinell hardness in the bore of 196. It was found that if the carbon equivalent was maintained in this range, provided the carbon did not run lower than 3.10 per cent., no difficulty was experienced from shrinkage defects. But if composition was changed to give a carbon equivalent of 3.60, shrinkage defects developed at point A in the form of a closed pipe, and, if metal of this composition was poured very hot, 1,510 deg. C. or over, a combination blow, from excessive trapped gas generated from the jacket core assembly, and shrinkage defect, which caused the casting to leak when the oil line AB and AC was drilled, developed.*

Identification of Contraction Defects

Contraction defects are those defects that develop in castings due to internal stresses that are set up within the casting while cooling from solidification point to room temperature.

Probable Causes

These defects are primarily due to the arrest or prevention of contraction of one section of the casting by another section, or by hard cores, or hard-rammed moulds. The tendencies of any casting to warp or crack, due to internal stresses, are governed by the following factors: (1) Variation in rate of cooling; (2) composition; and (3) strength and temperature of section at stress application.

The variation in rate of cooling is by far the most important factor, as it determines, to a large extent, the amount of internal stress developed and the temperature at which the stress is applied to any given section. Everything else being equal, the tendency to warp or crack is dependent upon variation in section, or, in other words, variation in cooling rate. This fact was well demonstrated by L. A. Danse.* For any variation in cooling rate, the tendency to crack or warp is influenced by the solid contraction, which in turn is dependent upon the condition of the carbon, *i.e.*, combined or graphitic. This, in turn, is governed by composition and rate of cooling. Slow cooling tends to increase graphitisation.

The warping or cracking of any casting is also dependent upon the strength of section when stress is applied. If the section is too weak, the casting will crack, but if it is strong enough to compress or bend a heavier section which is at a higher temperature, then the casting will probably warp. With still stronger sections, the casting may remain in a state of stress, which fact may be easily demonstrated by sawing or machining.

Methods of Correction

The obvious correction for this problem is the elimination of variation in rate of cooling. Some of the methods by which this can be accomplished are:—(1) Different gating methods; (2) preheating certain parts of the mould; (3) change in shakeout time; (4) use of cooling oven; (5) change in the position of the casting in the mould so as to facilitate gating through thin sections; (6) change in design of casting to give more uniform section size; and (7) the use of cores that collapse readily and permit free contraction of the casting.

In some cases, warping is compensated for by cambering the pattern; in other cases, corrected by firmly bedding-in and uniformly hard ramming. Under certain conditions cracking or warping of castings has been eliminated by changing composition of the metal so as to give lower combined carbon, thereby reducing solid contraction.

2.—Cracked Castings

Classification

Cracked castings may be classified under two general classifications as to cause:—(1) Cracks which are due to internal stress developed within the casting (cracks from this cause have already been discussed under "Contraction Defects"); and (2) cracks which are due to the action of external stresses upon the casting.

Probable Causes—Rough Handling

The correction of this defect will be apparent, when, from close observation, it is found when, where and how castings are being cracked in the handling process.

3.—Hard Spots

Definition

Hard spots in castings are small areas that can be found without the aid of a microscope and which are large enough to prevent or interfere with machining of the casting. These areas may be high in combined carbon, or may be due to undissolved alloying agent that was added to iron which was too cold to dissolve completely and so form a homogeneous liquid. These hard spots will be classified according to the source of their probable cause.

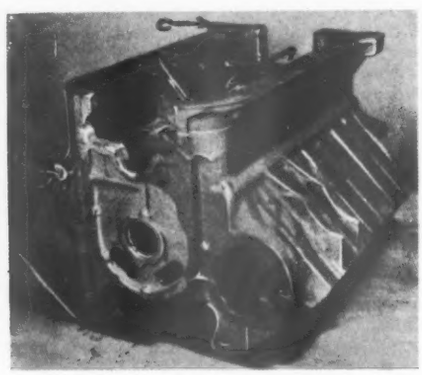

FIG. 4.—CASTING WHICH SHOWED DEFECTS AT A, B AND C IF CARBON EQUIVALENT AND POURING TEMPERATURE WERE NOT CLOSELY CONTROLLED.

Probable Causes

The probable causes of hard spots are as follow:—

(1) Metal conditions: (*a*) Composition, *i.e.*, low carbon, low silicon, or too high in carbide stabilising elements for the section thickness; and (*b*) cold iron is a cause of hard spots especially if the metal must have alloy additions made to it (hard spots also occur when thin sections, that have to be machined, are at points far removed from gates).

(2) Moulding conditions, cores and methods: (*a*) Flask bars too close to the mould cavity; (*b*) foreign matter in the sand, such as lumps of metal, coal or coke; (*c*) improper use of chills; (*d*) fins projecting into core, mould face or between core and mould face from thin sections that have to be machined; and (*e*) core rods or wires exposed.

(3) Patterns improperly designed so as to place thin sections that have to be machined in the cope rather than in the drag where the least chilling tendency is present. If possible, patterns should be designed so as to gate through the thin section.

* The idea seems to be prevalent among some foundrymen that hard cores, wet cores, green cores, hard-rammed moulds, sand high in moisture, low in permeability, etc., can cause shrinkage defects. The author fails to see how these conditions can possibly affect the volume change of the metal, either in the liquid state or during solidification. Therefore, the effects of these conditions will be discussed under blows and contraction defects.

4.—Cold Shuts

Definition

The term "cold shut" means a condition where the metal is imperfectly coalesced in one or more places. This may also have the appearance of a "crack," but on close examination the inner surfaces are found to be perfectly smooth, showing no sign of fracture. Sometimes cold shuts are noted in sharp corners or projections which fail to fill perfectly and are rounded. In some cases, partial coalescence leaves a line of weakness, which later would probably crack if the casting inadvertently passed inspection, and was placed in service.

Probable Causes

The probable causes of cold shuts may be listed as follow:—(*a*) Cold iron (pouring temperature too low); (*b*) iron low in fluidity; (*c*) improper gating; (*d*) pouring interrupted or slackened before completion; (*e*) conditions which give rise to excessive gas; (*f*) hard ramming; (*g*) cope and drag shift or core shift; and (*h*) worn pattern or core boxes.

Determination of True Cause and Correction

If the defects result from causes *a*, *b*, *c* or *d*, or any combination of them, the surface of the casting will have a smooth, shiny appearance, not showing the imprint of the sand pattern of the mould face. To determine which of the above causes produce the defect, check other castings of similar section thickness made on the same production line and poured at approximately the same time. If they show similar signs to those described above, then *a* is the cause. One should change the melting or hot-metal transferring practice to be sure of hot metal at the pouring station.

If *b* be the cause, the iron may appear normal when first tapped (unless it is oxidised), but it has no "life" or "dies quickly," that is, a white oxide film or scum forms on the surface of metal in the ladle. This may be caused by low silicon, carbon or phosphorus. After checking the records of melting practice and chemical analyses, make the necessary changes to give the correct composition.

If *a* and *b* be not the causes, then check *d*. If *d* is not the cause, change *c* so as to get the metal in the mould faster and at correct positions.

If the defect be caused by *e* or *f*, it should really be classified as a blow. The casting, except in the immediate vicinity of the defect, will plainly show the imprint of the sand pattern of the mould face. The defect occurs as a rounded or oblong hole in the casting wall rather than as that described for *a*. For corrections see the section dealing with "Blows" (No. 6).

If the defects be caused by *g* or *h*, the wall of the casting will not be of correct metal thickness. For corrections, if *g* be the cause, see "Shift" (No. 12) under the heading "Not True To Pattern." If *h* be the cause, then build the core box or pattern up to correct size.*

5.—Slag Inclusions

Identification

Slag inclusions in castings are those that appear on the surface of the casting in the vicinity of the gates or along the line of flow of the metal. The material in these inclusions has a vitrified appearance. The cavities left after removing this material have a rounded, dull black appearance, not showing the imprint of sand.

Probable Causes

The casting defects resulting from slag inclusions may be classified under two general classifications as to the source of slag:—(1) Inclusions caused by poorly skimmed metal or metal containing entrapped slag, and (2) inclusions resulting from the mould.

The source of the entrapped slag may be from any one of the following causes, such as: (1) oxidised iron; (2) wet sand bottom in the cupola; (3) spout or ladle lining material of low refractoriness; (4) iron melted too cold to free itself of entrapped slag, and (5) dross from ladle additions, alloys, etc., not properly skimmed.

Slag inclusions that have their source in the mould, in most cases, will contain a dark cinder-like slag. These inclusions may be due to any one of the following causes:—(1) Using materials in the construction of the mould that have too low refractoriness for the pouring temperature of the metal; (2) incorrect gating practice, and (3) moulding sand incorrectly conditioned.

Methods of Correction

The general rules for avoiding slag inclusions in castings are: (1) operate the cupola correctly using high-grade refractories, and (2) skim the metal thoroughly before pouring into moulds that are correctly gated, rammed and made from properly conditioned sand that is high enough in refractoriness to withstand the pouring temperature of the metal.

6.—Gas Holes and Blows

Gas Holes (Pinholes)

Defects of this type may be classified under two general classifications as to source:—(1) Metal containing entrapped gas or oxidised metal, and (2) condition of the mould. Those holes due to the condition of the metal before pouring are generally distributed throughout the casting but, in most cases, are more numerous in the vicinity of the gates and in thin flat sections. These holes are rounded, smooth and shiny and do not make their appearance until the casting is partially machined, or is fractured.

Those holes due to the condition of the sand are easily distinguished from those due to the metal condition. Such holes are of irregular shape and, in most cases, have a small opening through the surface of the casting. The surface of these holes is dull black or bluish grey in colour, and does not have a shiny appearance. They are not confined to either cope or drag surface, but generally are more numerous on cope surfaces of flat sections and near the gates.

Probable Causes

Gas holes or pinholes, due to the condition of the metal, may result from any one of the following causes:—(1) Including badly oxidised scrap in cupola charge; (2) wet sand bottom in cupola; (3) green ladle or pouring spout; (4) low coke bed at any time during the heat; (5) coke too large for size of cupola; (6) too much shot metal in the charge, and (7) scrap too large for size of cupola.

To determine which of the above are the cause of the defect will require close observation of the entire melting and hot-metal transfer practice by an experienced foundry metallurgist. Those pinholes that are due to the condition of the sand are simply a multitude of small blows. These small blows are probably caused by one or more of the following:—(1) High moisture; (2) hard ramming; (3) lack of vent holes in the sides of flasks and bottom plates, and (4) sand not thoroughly mixed. In the author's opinion, the chief causes are a combination of high moisture and a sand high enough in permeability so as not to produce large blows, but low enough in permeability to cause very small bubbles of gas to be forced into the surface of the casting while it is solidifying.

Blows

Defective castings of this type are those which show unnaturally smooth depressions on either the inner or outer surface of castings. These defects also appear as rounded or oblong holes through the wall of the casting. The castings, except in the immediate vicinity of the defects, will show plainly the imprint of the sand pattern on the mould or core face. Then there are those defects that show up as large gas holes on the cope side of castings or in some heavy section above an improperly vented pocket or cored cavity.

Probable Causes

Blows may be divided into two general classifications as to cause, namely, mould and core, as follows:—(1) Mould blows: (*a*) Sand conditions—(i) low permeability, (ii) high moisture, and (iii) too much coal dust; (*b*) hard ramming (produced low permeability); (*c*) rusty or wet chaplets; (*d*) character of the mould spray; (*e*) sprue head too low, and (*f*) failure to vent pockets.

(2) Core blows: (*a*) Hard cores; (*b*) insufficiently baked cores; (*c*) cores incorrectly vented; (*d*) coal dust in the mixture; (*e*) oxidised or wet chills; (*f*) patched cores, and (*g*) permeability of core too high or too low.

Methods of Correction

Defects Due to Mould Conditions.—The true cause and correction of the blow or blows will be very easy to determine upon close examination of the defect as to appearance, location and correlation with records of that day's production, provided complete records are kept. For example, if the blow is due to the condition of the moulding sand, such as low permeability, in most cases, it will show up as an unnaturally smooth depression on heavier sections or as a hole in thin sections, with the largest end of the hole next to the green sand. If, however, the blow was due to high moisture and low permeability (hard ramming), it will appear similar to that described above, with the exception that it will have little needles or rough projections of metal protruding from the contour of the defect.

To determine if the low permeability was due to hard ramming or fines (fine grains of sand, dehydrated clay, etc.), it is necessary to check the records of sand test results. If the permeability was correct, then the low mould permeability was due to hard ramming. *Remedy*—reduce the amount of ramming. However, if the sand test results showed low permeability with correct moisture and strength, then the low mould permeability was due to the sand containing an excessive amount of fines. *Remedy*—reduce the fines, or add clay-free silica sand.

If the blow was due to too much coal dust, it will have the same appearance as that for low permeability, with the important exception that before cleaning the casting in the vicinity of the defect, it will have a coating of black shiny flake carbon. *Remedy*—reduce the coal-dust additions to the facing sand. If the defects were due to *c* or *f*, the location of the defect would indicate the cause. The correction is obvious. If the blow was due to *e*, the defect will show on the cope side of the casting, generally on some section of the casting that protrudes above the main body of the casting and approaches the height of the sprue. *Correction*—use a deeper cope flask; use a runner-box on the top of the cope; and reduce the amount of ramming over this section, or vent freely.*

(To be continued.)

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* Core boxes and patterns used on production jobs, where ramming of the mould or core is accomplished by the use of Sandslinger or core blower, should often be checked for wear, especially those boxes or patterns made of aluminium or any material of low abrasive resistance.

* Cope and drag flasks and bottom plates should have ample vent holes.

Rationalisation of the Foundry Industry

MR. W. J. PETERSEN'S PRESIDENTIAL ADDRESS

A meeting of the Institute of British Foundrymen (South African Branch) was held in Johannesburg on August 22, and was attended by members from as far afield as Vereeniging and the Far East Rand. At the opening of the meeting the chair was taken by MR. J. TONGE, who called upon Mr. Petersen, the newly-elected President, to deliver his inaugural address. Mr. Tonge congratulated Mr. Petersen on behalf of the meeting on his accession to the presidential chair, and wished him a successful year.

RATIONALISATION OF THE ENGINEERING INDUSTRY IN SOUTH AFRICA, WITH SPECIAL REFERENCE TO THE FOUNDRY SECTION

PRESIDENTIAL ADDRESS BY MR. WALTER J. PETERSEN

The engineering industry in South Africa was, for many years, not a real industry, but a collection of workshops all engaged in jobbing and repair work, all new machines and intricate spares being imported. But the inevitable industrial development took place. More and more parts were manufactured in the country, until many complete machines were made, which were found to be equal in quality, and in some cases even superior, to the imported article. The war of 1914-18 accelerated the process, but earlier development is nothing as compared with the industrial development which is taking place to-day. The tragedy which has overwhelmed the world has thrown South Africa on to its own resources, and in it to-day are being done jobs which, even a year ago, would have been classed as impossible.

To-day the engineering industry is not only making munitions of all kinds, but also the tools, jigs, and even many of the machines necessary to make these munitions. These munitions require a degree of accuracy hitherto rarely required for ordinary commercial work, and the latent capabilities of the workmen have been revealed. Difficult problems have arisen, but it is a matter for satisfaction that all have been solved, as will any others that may arise. Moreover, production has been increased and maintained mainly because of a degree of co-operation hitherto unknown in local industry.

Rationalisation Defined

Before proceeding, it will be advisable to explain briefly the meaning of rationalisation. Burnham, in his book, "Engineering Economics," states:—

> "Rationalisation has been defined as a combination of units in an industry with the object of cheapening production and increasing efficiency. The economies of co-ordination and amalgamation are developed to the utmost. It implies deliberate concentration on low costs of production by sectionalising output, allocating it to the most efficient works, closing down unremunerative or redundant works, with due regard to the maintenance of reserve plant, the installation of the best cost-saving machinery, and the centralised control of purchasing and selling. Rationalisation involves the conscious planning of industrial enterprise and the elimination of waste in materials, human effort and distribution."

From the preceding observations it will be seen that rationalisation already exists in the Rand industry to a certain extent. A few years ago all the engineering firms were engaged in general engineering, and all was grist that came to their mill. Latterly certain firms have specialised, and have concentrated their efforts in certain directions such as rock-drill spares, winches, tube-mill liners, pumps, etc. Some steel foundries concentrate on castings only, and do not undertake machining of any kind, leaving this to the machine shops.

Cost of Estimating

As South Africa is still—if not in its infancy—at least in its industrial childhood, the time now seems ripe to consider some further degree of rationalisation. Rationalisation may be summed up in two words, *viz.*, "industrial efficiency." Looking at the picture from this angle, one finds the first source of waste—waste of energy in estimating—and here the building industry is ahead of engineering. On jobs exceeding a certain value, builders are not permitted to quote unless a "bill of quantities" of materials be furnished by the party calling for the tender, the tenderer filling in his prices for the various items on the schedule, which procedure will probably only take 10 per cent. of the time taken to draw up the bill of quantities.

Assuming that it takes one hundred hours to take out a bill of quantities, and ten hours to fill in the appropriate prices with the necessary extensions, and that only five firms are asked to tender, then on the bill of quantity basis a total of 100 plus 5 × 10, *i.e.*, 150 hours, of labour, are required. If each of the five firms takes out its own quantities, each firm must devote 100 plus 10 hours, *i.e.*, 110 hours, to the job, involving a total of 550 hours compared with 150, and 400 hours have been wasted. As the cost of this time must be paid for, it is obvious that the bill of quantity system must pay, the consumer ultimately getting the benefit.

There is no valid reason why the same system cannot be applied to the engineering industry—not necessarily on each and every job, of course. Examining the system from the point of view of the foundryman, it is revealed that the weight of the castings required by any consumer will probably take considerably longer to calculate from the drawing than will the determination of the patternmaking, moulding and machining time; and hence the actual price, once the weight be known. If the estimated weight were given by the consumer, shorter time would be required by the tenderer in which to submit his tender, resulting in better service to the consumer, reduced overheads to the producer, and an ultimate saving to both.

Unnecessary Patterns

A second source of great waste, from the foundryman's point of view, is the making of unnecessary patterns. For every new job a pattern must be made and must be paid for by someone. Consider a case such as the following: A, B, C, D and E quote for a job in open competition. A is the successful tenderer and executes the job, presumably to the satisfaction of everyone concerned. The pattern is carefully stored, which incidentally costs money, which must come out of A's pocket, for it is doubtful if any tenderer allows for storage charges, and not all consumers ask for the pattern to be handed over with the job. A couple of years later the same job (or its twin, possibly for another customer) is again put out to tender. D may now be the successful tenderer. He then repeats the making of the pattern and delivers the job. This may be repeated several times. There are now at least two patterns in existence for the same job, and both paid for. Obviously the labour and material expended on all but one have been wasted. Is this industrial efficiency?

A central patternmaking shop and store for the whole industry would cure this evil, but there are practical difficulties in the way which, although not insoluble, are not easy to solve. Further consideration of the subject will reveal cases for the extension of rationalisation in many more directions.

At first sight the introduction of rationalisation, with its resultant employment of a certain number of semi-skilled men on semi-skilled jobs (*i.e.*, on jobs which tend to make the trained man tired of life) would appear to be the enemy of the skilled man. If South Africa were already fully developed and industrialised, there would be reason for this fear, but the country is not fully developed or industrialised as yet, and therefore there is plenty of room for the highly-skilled man of to-day; also for his sons, should they care to follow in his footsteps. They will all be needed, and in the superior positions; *i.e.*, as foremen, charge-hands, supervisors, and also as skilled mechanics—for no industry can run on operatives alone.

DISCUSSION

MR. LION-CACHET said that all present had listened with great interest to the President's address. Mr. Petersen had mentioned that the engineering industry in South Africa had for many years been just a collection of workshops engaged in jobbing and repair work, but "time marches on." Time had marched on very slowly, commented Mr. Cachet, so far as rationalisation was concerned, until a Branch of the Institute of British Foundrymen was started in South Africa. Since then co-operation had greatly increased. Members visited each other and showed one another what could be done. That spirit should be encouraged to the greatest possible extent.

With regard to tendering in the building industry, the speaker observed that he had often looked through a bill of quantity with envy, and thought how wonderful it must be to tender on a job where the tenderer knew exactly "what is what." In the case of a bill of quantity, any alterations, additions or mistakes were adjustable, for quantities were checked on the completion of the job and must be exactly right. Should there be any excess the builder received extra pay at the rate tendered. Members were all aware of certain difficulties in the foundry profession. Sometimes it happened that a casting came out considerably larger than it was meant to be. If the quantity surveyor who took out the weights of the job concerned was accurate in his estimates, the foundry would certainly lose the advantage of the extra weight which under present conditions was often gained. Again, bills of quantities might lead to arguments between foundries.

The making of unnecessary patterns was already beginning to be eliminated by the Institute. He, personally, used acquaintanceships made through the Institute in borrowing patterns. Here again the Institute had proved of value. The chairman had mentioned the practical difficulties relating to the establishment of a central pattern shop and store. Mr. Lion-Cachet agreed that there would be many difficulties. He visualised a shop run by a committee representing various firms which cut patterns to design. He had great pleasure to proposing a vote of thanks for the address, which had been greatly enjoyed.

More Drawings Desirable

MR. WARD seconded the vote of thanks. In regard to the question of rationalisation, he said that he had experienced one form of vexation. How often did foundries get an order for a particular casting and have to send out a traveller or patternmaker, or 'phone for a drawing, only to be told that there was no drawing

For High Quality Castings

The increasing demand for high-strength close-grained iron castings calls for improved metal. In comparison with the accepted standards of the past, the modern high quality casting requires lower total carbon and phosphorus, with a closer range in silicon. The Ironfounder can now meet this demand at a reasonable cost by the use of Stanton-Dale Refined Pig Iron.

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available, but there was a worn casting from which the size could be obtained? In the case of a machined casting this might be satisfactory, but with rough castings which were not machined there might be two or three castings, perhaps from different foundries, and the variations might be serious. It might easily happen that the casting selected for copying was the wrong one. An important point in rationalisation would be the provision of further drawings by customers. In connection with patterns, it had been suggested that contracts for longer periods would help. However, the pooling of patterns or the purchase of patterns by customers would eliminate a certain amount of vexation and expensive duplication. His only criticism of the value of a central pattern store was that only very rarely did two foundries make castings in the same way.

MR. TONGE thought members would agree that the President had started off extremely well by allowing discussion on his own address. It was usual for a President to say exactly what he wanted without fear of contradiction. He congratulated Mr. Petersen on his bravery in exposing himself to criticism.

MR. PETERSEN thanked members for their appreciation, and said he welcomed further discussion.

Variation in Estimates

In regard to quantities, MR. BRAGG pointed out that estimates varied very considerably. On measuring up and checking quantities after the completion of the job, it was sometimes difficult to find the source of the extra weight. He did not think bills of quantity would prove very satisfactory in a steel foundry, and considered that they would have to continue with the old system of selling castings by weight. He felt that foundries would find difficulty in adopting the methods of the building trade.

MR. STONES said that in view of present circumstances he was strongly of opinion that every member should have been present at the meeting to discuss the rationalisation of the foundry industry in relation to the war. He believed that it was impossible to rationalise foundries in commercial enterprise. Every country in the world had built up its industries through enterprise. He also pointed out that every customer had different patterns, and that four customers in six would even have different patterns for a 4-in. pump. Thus Mr. Petersen's remarks about a pattern store were not applicable. He thought that it would not be in the spirit of commercial enterprise to borrow patterns. He also believed it was impossible to compare the building and engineering industries. There were, however, many jobs for which customers could stabilise their patterns or requirements, thus making it much easier for the engineering industry to quote a cheaper price. By attempting to make every foundry do the same job in the same way, no progress would be made. In order to reach a goal it was necessary to fight to beat the competitors.

MR. LION-CACHET thought that it was necessary to take a broader view. The foundry industry was only a very small part of the mining industry, which was also built on enterprise. Enterprise meant trying to do things better than they were done before. If a mining engineer thought he could improve the running of his plant by changing the dimensions of the impeller by ¼ in., he was more than justified in doing so, even if it added to the difficulties of tenderers and involved changing patterns. Even if patterns had to be changed a hundred times, the mining engineer was justified if he obtained 1 per cent. more efficiency in consequence.

A MEMBER said he thought some members had missed the point regarding quantity surveying. A man about to erect a building had his quantities taken out and submitted them to tenderers. Similarly, weights could be taken out and submitted to foundries. It was then only a matter of estimating such factors as machine time, etc. In the event of a casting coming out considerably heavier than the estimated weight, the firm could be compensated. However, an estimator would naturally work within safe limits.

MR. WEST was of opinion that the mining industry would become increasingly rationalised as time went on. For instance, tube-mill balls had already been standardised, and there was no reason why truck bearings, for example, should not also be standardised at a future date. Certain other items would eventually also be standardised.

Customers Should Supply Patterns

MR. HOLDSWORTH recalled that when he came to South Africa in 1935 and saw the systems adopted in regard to quantities for jobs, he was surprised to learn that each firm made a set of patterns. When jobs were tendered for overseas, the pattern was supplied by the customer in every case. The need for a central pattern store would be eliminated if customers supplied their own patterns. If the customer had a pattern for a 4-ton casting and the casting came out heavier, it would be his own fault. This system would save a large amount of superfluous patternmaking, which was money wasted. Then, too, all foundries would start on the same level, and no firm would be able to quote less because it had a pattern. Referring to a point raised by Mr. Lion-Cachet, Mr. Holdsworth saw no reason why foundrymen should pay for the engineer's experience. If the engineer had a pattern of his own, he could alter it to suit himself.

MR. ALDRIDGE asked whether efficiency would not be lessened if customers supplied the patterns, instead of leaving them to be made by the engineering shops. Moreover, a pattern was valuable and would have to be stored, and thus rationalisation would be far from being achieved. He also inquired what forces were at work to achieve rationalisation, and who was going to determine the most efficient methods of cultivating it.

MR. HOLDSWORTH, in reply, said that in regard to the storing of patterns he thought Mr. Aldridge had missed the point. His firm, for example, made tube-mill spares for a particular mine. All their competitors also carried sets of patterns. If the mine had its own patterns there would be only one set, which would be sent as required to the firm supplying the best article.

MR. WEST pointed out that so many foundries had different methods of moulding that patterns must be made to suit particular machines. If a customer had his own pattern and sent it to a foundry, the foundry might alter it to suit the job. The next time the customer sent his pattern to another foundry and it might again be altered. This would lead to unnecessary expense, and was certainly not rationalisation. He also instanced the case of a customer who decided to try to store patterns and issue them when required. Unfortunately, the experiment was not successful. An enormous amount of work was necessary if one little core box was lost. In some cases, it was almost equivalent to making the pattern over again.

MR. TONGE said that unfortunately only the successful prosecution of the war could show how far rationalisation could be brought about. Specialisation might come about, however, and would need a spirit of friendly co-operation.

Brochure

MR. PETERSEN announced that the Council had decided to proceed with a brochure, which he hoped would be published in the near future. It would be a collection of Papers with a few general notes, and would serve as a volume of reference for members. There would also be surplus copies, which they hoped to use for propaganda purposes.

Precautions in Lighting Oil-Fired Furnaces

At a meeting of the Philadelphia section of the Association of Iron and Steel Engineers, a series of Papers on "Safety Fuel Engineering" was presented by members of the fuel department of the Maryland Plant of Bethlehem Steel Company, Sparrows Point, Maryland. One of the Papers* dealt with "Safety Procedure in Heavy Oil-Fired Furnaces." The author, MR. E. C. DAVIS, points out that the procedure to be followed in lighting an oil-fired furnace is as follows:—

(1) Open flue damper and sufficient furnace doors to give free vent to any explosion that may occur while lighting the burner. (2) Start furnace fan, and allow air to circulate in the furnace for a few minutes. (3) Make sure that all burner parts are in place, and that hoses, unions, etc., are tightly connected. (4) Examine the furnace for oil or oil fumes, and if found, remove same before lighting the furnace. (5) Make sure that all burners on the furnace are turned off before attempting to light any one of them. (6) Use a torch or wad of oily waste large enough to provide a steady flame for several minutes. (7) Always turn on air supply to the individual burner before turning on the oil, and follow the reverse order in shutting off a burner.

(8) If it becomes necessary to adjust the position of a burner, turn off oil before making such adjustment. This precaution will prevent what might otherwise be a serious burn if the burner should slip away from the burner port and splatter against the side of the furnace. (9) When lighting a cold furnace, make sure that the burner is burning with a steady flame before leaving the furnace. Usually the first five to ten minutes will determine whether the burner will stay lighted. (10) If a yellow or white fume begins to appear when lighting a cold furnace, shut off oil immediately, and keep open lights away from the furnace until the atmosphere clears. These fumes are really nothing more than oil fog, and indicate that there is not sufficient heat furnished by the pilot light to sustain combustion, or that the proportion of air to oil is outside the explosive range. (11) The person lighting the furnace should have a light-up kit consisting of kerosene, oil-soaked waste, a wire fork for holding the waste, and matches. Never try to light an oil burner with a poorly burning torch.

* From "Iron and Steel Engineer."

Licences for Steel Exports

Under a Board of Trade Order which came into force on November 7, licences will be required to export to any destination the following manufactures of iron and steel (including alloy steel):—Colliery arches and pit props; girders, beams, joists and pillars, whether fabricated or not; hoop and strip; plates and sheets of all kinds; railway and tramway material, including rolling stock, buffers, springs, laminated or coiled, wheels, tyres and axles, whether assembled or not, fishplates and sole plates; wire nails and wire staples, but not including machine staples and insulated staples; wire netting, wire fencing and wire mesh.

It is made clear that: (*a*) the prohibition in respect of angles, shapes and sections of iron and steel includes fabricated goods and hollow mining drill steel; (*b*) the prohibition in respect of bars and rods of iron and steel includes hollow mining drill steel; (*c*) the prohibition in respect of wire of iron and steel includes barbed wire; and (*d*) the prohibition in respect of angles and shapes of iron and steel does not include machinery parts.

The existing licensing requirements with respect to certain kinds of plates and sheets of iron and steel have been extended.

Applications for licences should be made to the Controller, Export Licensing Department, Inveresk House, 346, Strand, London, W.C.2.

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The Week's News in Brief

Trade Talk

THE PRODUCTION OF LOW-PHOSPHORUS pig-iron in Japan, which has been on a small scale in the past, will be much increased as a result of the experiments now completed by the Kurimono steelworks, using purple ores and magnetic iron ores. The company is to install the necessary plant for production on a commercial scale, and proposes to start the manufacture of pipes by the centrifugal process.

A NEW CENSUS of the utilisation of machine tools is being undertaken at once, and with a view to ensuring that the fullest possible use is made of machine tools throughout the country, it is likely that a census will be undertaken about every three months. Mr. P. H. Mills, the Controller of Machine Tools, speaking in London, said that all machine tools must be put into full service. He asked that every machine tool which could not be properly employed should be turned over to the Ministry of Supply.

THE engineering employers have informed the unions of the men in the industry that they could not accede to the applications for higher wages. Sir Alexander Ramsay, director of the Engineering and Allied Employers' National Federation, stating the employers' reasons for the decision, produced figures of actual earnings in the engineering industry and another table of comparative earnings in engineering and other industries to demonstrate that engineering workers are not in a disadvantageous position. He also pointed out that an advance of wages in engineering would add to the cost of war production, and therefore to the national expenditure; and the burden must fall on the community.

THE Ministry of Labour and National Service announces various changes in the Schedule of Reserved Occupations. The ages of reservation of the following occupations have been raised as follows:—Scientific research worker (full time) in a university, technical college, research association, research institute, or research laboratory, 30 (25 previously); oiler, cleaner (stationary engines, cranes, pumps, lifts, conveyors, and similar machinery), 35 (30). As from December 1, the ages of reservation of the following occupations will be raised from 30 to 35:—Britannia metal smith, maker-up white Britannia worker (general hand), maker-up (wire work). As from December 1, the following occupations, previously reserved at the age of 30, will cease to be reserved:—Brass bedstead maker, stock fitter, frame setter (metal bedsteads), railer, bedstead caster, assembler, rough fitter, bedstead fitter (compo man) (including foreman, charge hand).

Obituary

MR. ROBERT RICHMOND, a member of the firm of John Richmond & Company, metal merchants, West Regent Street, Glasgow, died recently.

AT one time proprietor of Kershaw & Bullock's Ironfoundry, Randfontein, Transvaal, South Africa, and formerly in business in Sheffield as an ironfounder, the death has occurred of Mr. Ronald J. Hardshaw at the advanced age of 92. He was in the Transvaal for 38 years.

MR. ARTHUR SLADDEN, who died a few days ago at the age of 84, had a life-long association with the iron and steel industry of Tees-side and South Durham. When the South Durham Steel & Iron Company, Limited, was first formed in 1898, Mr. Sladden was appointed its secretary, a position which he held until a few days ago.

THE death has taken place suddenly, at his residence, Burncroft, Thorntonhall, of Mr. William Jarvie, a director of William Baird & Company, Limited. Bairds & Scottish Steel, Limited, and the National Benzole Company, Limited. A native of Glasgow, he had been associated with Wm. Baird & Company practically all his working life. In 1925 he was appointed to the board. After the amalgamation of Baird's interests in Lanarkshire, Stirlingshire and Dumbartonshire with those of Scottish Iron & Steel Company, he joined the new board of Bairds & Scottish Steel, Limited.

Personal

SIR CLIVE BAILLIEU has been elected chairman of the Zinc Corporation, Limited, and Mr. L. B. Robinson has been elected to a seat on the board.

MR. H. H. SHEPHERD, chairman of the East Anglian Section of the Institute of British Foundrymen, has changed his address to 266, Colchester Road, Ipswich.

MR. ARTHUR THOMAS WALL has relinquished the managing directorship of J. Samuel White & Company, Limited, on account of ill-health. He has held the position since 1933.

MR. JOHN A. MCCULLOCH has lately retired from the position of secretary to R. & W. Hawthorn, Leslie & Company, Limited, engineers and shipbuilders. He entered the service of the firm 38 years ago.

MR. ROBERT STEWART JOHNSON has been elected chairman of directors of Cammell Laird & Company, Limited, in place of the late Mr. W. L. Hichens. Mr. Johnson also retains the position of managing director.

MR. JOHN HUGHES, joint managing director of Tweedales & Smalley (1920), Limited, ironfounders and textile machinists, is among the new magistrates for the Oldham (Lancs) Borough appointed by the Duchy of Lancaster.

MR. FRANK CROFT, youngest brother of the founder of the firm (the late Mr. F. L. Croft) and Mr. Fergus Hansom have received presentations on completing 50 years' service with Crofts (Engineers), Limited, of Bradford.

MR. JAMES G. WEIR, director of J. & G. Weir, Limited, Cathcart, has been appointed Controller General of Supply. He will have full charge within the British Purchasing Commission of New York of work falling within the scope of the British Ministry of Supply.

MR. P. B. BROWN has been appointed chairman of Hadfields, Limited, in succession to the late Sir R. A. Hadfield, Bt., and Major A. B. H. Clerke has been appointed to succeed Mr. Brown as deputy chairman. Mr. P. B. Brown joined the company in 1888, the year of its formation, was appointed a director in 1909 and a managing director in 1917, becoming deputy chairman in 1930. Major Clerke joined the company in 1911, was elected a director in 1913 and a managing director in 1917.

MR. T. T. WATSON, who has been appointed research metallurgist of Lukens Steel Company, Coatesville, Pa., in charge of all plant research, left this country in 1930 to go to the States. He received his training at the Royal Technical College, Glasgow, and joined David Colville & Sons as assistant metallurgist immediately after graduation in 1923. He served in that capacity until 1925, when he became metallurgist for the Clyde Alloy Steel Company. From 1927 to 1930, Mr. Watson was assistant metallurgist with Dorman Long & Company. Since he has been in the United States he has served as a consulting metallurgist, and for the last nine years successively as member of the metallurgical department, and development and service metallurgist with the Lukens Steel Company.

Wills

NIGHTINGALE, F., of Langley, Worcs, managing director of the Langley Forge Company, Limited, and a director of Hughes-Johnson Stampings, Limited £27,520

BROWN, P. S., former chairman of the Caledon Shipbuilding & Engineering Company, Limited, and head of Brown & Tawse, Limited, iron and steel merchants, Dundee £198,304

Additional I.B.F. Diploma Award

In addition to the awards of diplomas made by the Institute of British Foundrymen which were announced in our issue of November 7, page 300, the Council of the Institute has now decided to award a diploma to Mr. F. G. Jackson for his Paper on "Some Jobbing Problems," which he presented to the Wales and Monmouth Branch in 1939.

Reports and Dividends

Meters, Limited—Interim ordinary dividend of 2½ per cent.

Wellworthy Piston Rings, Limited—Final dividend of 10 per cent., making 15 per cent.

Thompson Bros. (Bilston), Limited—Final dividend of 7½ per cent., plus a bonus of 7½ per cent., making 22½ per cent.

International Nickel Company of Canada, Limited—Quarterly dividend of 50 cents per common share, making a total distribution of $2 for 1940.

Birmingham Small Arms Company, Limited—Dividend on the ordinary capital of 7½ per cent. for the year ended July 31 last.

Smethwick Drop Forgings, Limited—Interim dividend on the ordinary shares of 12½ per cent. for the year ending March 31, 1941.

Lancashire Steel Corporation, Limited—Interim dividend of 2¾ per cent. on the 5½ per cent. non-cumulative redeemable second preference shares for 1940.

Heenan & Froude, Limited—Net profit, £50,405; final dividend of 5 per cent. (making 10 per cent. for the year to August 31), plus a cash bonus of 5 per cent.

Murex, Limited—Profit for the year to June 30, after providing for depreciation, £490,440; brought in, £90,167; taxation, £302,353; dividend for the year of 20 per cent.; set aside to meet the loss on sale of investments, £1,307; reserve for investments in enemy-occupied territory, £50,172; to general reserve, £37,070; carried forward, £103,423.

The Purchase Tax

Several decisions regarding liability to Purchase Tax have just been published as supplementary to those already given in Notice No. 78. The following items are of interest to the foundry and allied trades.

Class 7 (Lighting Fittings and Domestic Appliances, etc.)

Chargeable at the Rate of 33⅓ per cent.—Car heaters (except those operated from car batteries); food mixers of a capacity up to 12 quarts; additional attachments for food mixers (*e.g.*, drink mixers and fruit juice extractors); ice-cream freezers of a capacity up to 12 quarts; oil-burning nightlights consisting of container, oil absorbent and wick.

Not Chargeable.—Domestic cooking and heating appliances for solid fuel: Kitchen ranges and cookers constructed as single units over 66 in. in width; portable boilers over 15 galls.' capacity, and heating stoves of a heating capacity of over 10,000 cub. ft.

Class 9 (Hardware, Turnery, etc.)

Chargeable at the Rate of 33⅓ per cent.—Non-consumable firelighters; leak stops and pot menders; soap dispensers; draught excluders; fireguards; pulpware pails, bowls, etc.; "savings banks" other than of iron and steel hollow-ware; bootscrapers, except of the "built-in" type; button hooks; table bells; gas tubing in short lengths; rubber gas tubing connections; whistles and whistle chains; trivets; false bottoms, checks and coal savers; mantle rods; goffering irons.

Chargeable at the Rate of 16⅔ per cent. (Hollow-ware of Iron or Steel).—"Savings banks" of iron and steel hollow-ware; sanitary closets.

Not Chargeable.—Machinery belting fasteners; stirrup pumps; Anderson shelters; pulleys; fire extinguishers; rawlplugs and rawlplug sets; bedstead knobs; kettle and teapot knobs; buckets, contractors, industrial and dairy weighing over 45 lbs. per dozen; oil containers, oil measures and oil cans; "built-in" type bootscrapers; grave vases; cleat hooks; tassel hooks; rack pulleys; butchers' trays; specialised funnels (*e.g.*, grocers', garage, etc.); ice-cream serving utensils; choppers, axes and hatchets; glues.

Forthcoming Events

NOVEMBER 23.

Manchester Association of Engineers:—"Line Production of Machine Tools." Paper by O. Rendell, illustrated by a cinematograph film, at Manchester, at 2.30 p.m.

Institute of British Foundrymen

NOVEMBER 16.

East Midlands Branch:—"Randupson Process of Cement Moulding." Paper by F. W. Rowe, at Derby.

BASIC BRICKS: Spinella, Saxpyre, Supermag, Diazite, Dolomax.

•

SILICA BRICKS: Lowood, Meltham, Allen, Quartex.

•

FIREBRICKS: Glenboig Special, Glenboig Special Crown, Glenboig, Glenboig Crown, Castlecary, Dykehead, Gem, White Carr, Stour, Hycone.

Alumantine, Hysilyn, Adamantine, Llangennech.

•

CEMENTS: Sintex, Durax, Pyrolyte.

•

INSULATION: Amberlite Bricks, Cement & Concrete.

•

SANDS: Moulding, Brick Facing, Silica, Glass.

•

PLASTICS: Durax, Rotaline, Plastic K-N, Glendoline, Ground Ganister.

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SILLIMANITE: Tank Blocks, Bricks and Cements.

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BETWEEN users who exercise meticulous care and foresight in the selection of refractories and those who buy 'cheaply' regardless of quality—there are large numbers who acknowledge the value of a suitable refractory for their business, but lack the specialised knowledge, equipment and staff to compare refractory values. To them the General Refractories organisation has much to offer. For example, the "G.R." range of products will provide maximum service and efficiency for any stated purpose—"G.R." laboratories and staff are qualified to understand the problems of a user, to recommend the correct product and supply sound reasons for its selection. Thus users are assured of impartial and helpful service in selecting refractories. The continually increasing number of firms who make use of the "G.R." Technical Advisory Service is significant of the growing importance placed by users on the sound selection of refractories. With the changes imposed by war-time supplies of raw materials and production conditions, the vast resources of General Refractories are a definite assurance to users of maximum value-for-money.

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Raw Material Markets

Heavy engineering concerns continue to be fully occupied on work of national importance, while the position of the light-castings founders shows a further improvement. The latter have received more orders for castings from Government departments, while trade in builders' castings also is better. Generally, however, the light-castings trade is in need of work, and short time is unavoidable at some establishments. Adequate supplies of iron are being delivered to essential consumers, but home production has to be supplemented by imports in the case of certain grades.

Pig-Iron

MIDDLESBROUGH—Although many consumers had negotiated for their iron supplies up to the end of the year before the higher prices were announced, all deliveries are now subject to payment at the increased rates. Good tonnages of Midlands iron continue to arrive in this area, but current requirements only are being dealt with at the present time. In view of the meagre output Cleveland iron quotations are of little interest, but the revised figures for No. 3 G.M.B. foundry are £6 8s. per ton delivered Middlesbrough or Falkirk, £6 10s. delivered Birmingham, £6 11s. delivered Glasgow, and £6 13s. delivered Manchester, less 5s. rebate. Such is the demand for hematite that makers are accepting orders only for early delivery. Production is on a large scale, but it remains necessary to import iron in order to deal with users' needs. No. 1 East Coast hematite is now quoted at £6 18s. 6d. per ton delivered in Scotland and on the North-East Coast, £7 4s. in Sheffield, and £7 10s. in Birmingham, less 5s. rebate.

LANCASHIRE—Trade remains rather quiet in the light-castings section, and jobbing foundries generally report less work on hand. Notwithstanding these factors, however, the call for supplies of pig-iron is strong, particularly from speciality engineering concerns, which are fully engaged on urgent Government specifications. For delivery to users in the Lancashire price zone, Derbyshire and Staffordshire brands of No. 3 foundry iron are now quoted at £6 13s. per ton, less 5s. rebate, with Northamptonshire No. 3 at £6 11s. 6d. Deliveries of West Coast hematite are still restricted, the new price being £7 6s. 6d. per ton.

MIDLANDS—The placing of more Government work among light-castings foundries in this area has enlarged the demand for high-phosphorus iron, but no difficulty is being experienced in satisfying all requirements. This trade has also benefited by additional orders from building contractors, whose stocks appear to be in need of replenishment. Heavy engineering establishments mostly use low-phosphorus iron and hematite, supplies of which are still on the short side. The arrival of shipments from abroad is easing the position of home producers, and much larger imports are expected to be to hand in the early future. In addition to heavy engineers, machine-tool manufacturers are pressing for considerable tonnages of low-phosphorus iron and hematite.

SCOTLAND—Light-castings makers in the Falkirk district are securing sufficient iron from the English Midlands, but their needs are comparatively small, as the volume of Government work in their trade remains disappointing. Short time is reported by a number of concerns. Basic iron and hematite are in very heavy request, and the home producers are unable to cope with the pressure for supplies, but good-sized ship loads are forthcoming.

Coke

An increase in the price of foundry coke was expected to follow the new prices for iron and steel, and the quotation for Durham best foundry coke is now 2s. 6d. per ton higher at 58s., delivered Birmingham and Black Country stations. Users continue to call for large supplies to supplement their already substantial reserves and deliveries are quite satisfactory.

Steel

The steel industry generally is quite satisfied with the new price schedules announced by the Iron and Steel Control, and consumers are paying the additional sums without demur, it being appreciated on all sides that the step was necessitated by steadily rising costs of production. A further burden will be placed on producers as from December 1, but it is understood that the new prices have been fixed after due consideration had been given to the question of higher freight charges which come into operation on that date. Conditions in the steel market vary but little from week to week, as most works are fully booked up with Government orders over a lengthy period. There is little steel to spare after priority users' needs have been met.

Scrap

A survey of fixed and demolition scrap iron and steel, which is being made by the Iron and Steel Control of the Ministry of Supply, has already been completed in Somerset and Glamorgan—one largely rural area, the other industrial with great mining areas—and has revealed more than 20,000 tons of heavy scrap metal. While it is too early to assess the probable total resources which will be found throughout Great Britain, the officials are confident that at least 500,000 tons will be revealed. The survey has this week been extended to the whole of Scotland and the counties of London and Middlesex. Other areas will be tackled as quickly as the work can be organised. Buildings destroyed by enemy action in this war will soon be contributing twisted girders and iron work to the furnaces. In Cornwall tin mines which have been out of use a century will contribute their quota of scrap. Old pumps, beam engines, windmills, waterwheels and other items are being revealed, but discretion will be exercised to avoid the destruction of any objects which have a historical value. Demolition and clearance of the scrap have been started already in several areas, but completion of the survey in any area will not necessarily mean immediate clearance, for regard will be had to the type of metal wanted by the steelworks, the needs of particular works, and the transport facilities available. The main importance of the survey is the clear picture it gives of a vast stock which it will be possible to tap at will.

Notwithstanding the plentiful supply of most descriptions of scrap, the collection and sorting of fresh supplies is being pursued with commendable vigour. Consuming works are absorbing large tonnages, but ample supplies are being despatched readily and, in fact, useful reserves now exist at many works. A few months ago few would have been rash enough to predict that in November merchants would be experiencing considerable difficulty in disposing of certain grades of scrap, but such is actually the case, so appreciably has the supply position improved during the past few months. Foundries are being particularly well served by scrap merchants and licences issued by the Control authorities have been for generous tonnages, giving consumers the opportunity to provide against delayed deliveries in the future.

Metals

Sir Andrew Duncan, Minister of Supply, on Tuesday received a deputation of the London Metal Exchange, which put forward the case of metal dealers for more generous treatment by the authorities. No statement was issued after the meeting and none is expected, so that for the time being, at any rate, the exact nature of the discussion must remain known only to those present. It has been suggested that the Ministry of Supply should sanction a commission on transactions in copper, lead and spelter which are now being put through the Exchange between brokers' private consumer clients and the Ministry without profit to dealers. The Ministry, it is thought, might encourage such business on a commission basis instead of diverting traffic away from the Exchange and undertaking business direct with consumers.

Business in tin in London remains rather quiet and difficult. In the United States the Presidential elections have naturally disturbed dealings to some extent, but now that these are out of the way, it may be expected that buying will show a marked expansion. Recently consumers have bought only moderately, seemingly leaving the Metals Reserves Company to build up emergency stocks.

A list of five Bolivian ore producers participating in the agreement to supply the United States Metal Reserves Company with ores and concentrates in connection with the scheme for the establishment of a tin smelter in America has been issued, and an interesting omission is the Patino Mines concern. The following producers are participating:—Compania Aramayo de Mines en Bolivia, Compania Minera de Oruro, Compania Minera Unificada del Cerro de Potosi, Associacion Nacional Demineros Medianos, and Banco Minero de Bolivia.

The October issue of the Statistical Bulletin of the Tin Research Institute (controlled by the International Tin Research and Development Council) states that world production of tin in September is estimated at 22,600 tons, compared with 19,100 tons in August. The total production for the first nine months of the current year is approximately 167,400 tons, against 111,300 tons in the corresponding period of 1939. United States deliveries totalled 81,814 tons in the first nine months of the year, showing an increase of more than 75 per cent. compared with the deliveries of 46,620 tons in the first nine months of 1939. This year's deliveries include tin acquired for the emergency reserve stock. World stocks of tin, including smelters' stocks and carry-over, increased by 1,592 tons during September to 52,824 tons at the end of the month. Stocks at the end of September, 1939, were 39,398 tons.

The total visible supply of tin on October 31 was 34,311 tons, against 34,498 tons at the end of the previous month, according to Mr. W. H. Gartsen (Henry Rogers, Sons & Company). The carry-over in the Straits Settlements was 3,815 (2,262) tons, while the carry-over at principal European smelters was 2,580 (2,611) tons.

London Metal Exchange tin prices this week have been as follow:—

Cash—Thursday, £258 5s. to £258 10s.; Friday, £260 to £260 10s.; Monday, £258 5s. to £258 10s.; Tuesday, £258 10s. to £258 15s.; Wednesday, £259 to £259 5s.

Three Months—Thursday, £260 5s. to £260 10s.; Friday, £261 15s. to £262; Monday, £260 5s. to £260 10s.; Tuesday, £260 5s. to £260 10s.; Wednesday, £260 10s. to £260 15s.

Priority users of copper are consuming very large tonnages, and, although no figures may be divulged, it is certain that the rate of consumption has never been greater. The requirements of Government contracts are being well looked after, and the supply position should remain satisfactory in this respect, but little attention can be devoted to non-essential buyers. After the very brisk activity which has prevailed in the American market for many weeks past, a rather quieter tone has developed. Although only about 50 per cent. of the September total, domestic sales of the red metal in October were at the high level of 125,486 short tons.

Consumption of spelter in the United Kingdom appears to be expanding, but ample supplies are available and there is metal to spare in reasonable quantities for buyers other than those on priority lists. War needs of lead can be met in full without the slightest difficulty, while there is plenty of metal to release for other uses. Cable and battery makers are absorbing large tonnages, while paint manufacturers, too, are taking up considerable quantities. The American market is firm and the quotation has been raised by 15 points to 5.65 cents per lb., delivered New York.

Trading in non-ferrous metal scrap has recently improved and firmer prices have been obtained. Gunmetal scrap has been in especially strong demand.

Higher Coal Prices

RESULTS OF RISING COSTS

In order to meet the rising costs of coal production an increase of 1s. 9d. per ton in the pithead price of all coal has been sanctioned by the Government. A further increase of 1s. per ton has been authorised for South Wales and of 1s. 6d. for Kent to meet the special circumstances of those districts. The case of Durham is under consideration.

Wind from the right quarter . . .

With a favourable wind the clipper races across the ocean, her tall tapering masts and gleaming spread of snowy canvas providing a picture of loveliness and grace . . .

Industry also demands a satisfactory source of air supply, and instinctively turns to the manufacturers of Fans who have the necessary experience and knowledge which ensure the quality and efficiency of their products.

In Foundries, where comparatively high pressures are required for the supply of air blast to forges and cupolas, "Sirocco" High-Pressure Fans offer dependable service, and numerous installations testify to their excellence and suitability. A wide range of sizes and designs ensures correct fulfilment of individual requirements.

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Perfect Castings, only by using Perfect Cores!

Titan Core Stoves ensure Highest Core Quality with Maximum Output at Minimum Cost!

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What British Foundries say of Titan Core Stoves:

A Steel Foundry in the North: "The results in the new Core Stove are extremely satisfactory. The Drying of Cores is fast, economical and uniform."

A Grey Iron Foundry in the Midlands: "We have found the Korex Core Stove extremely satisfactory in every way."

A Malleable Foundry in Gloucestershire: "The Coke-fired 'Korex-Superkor' Core Stoves have given every satisfaction with regard to efficiency, economy and ease of operation. The quick and thorough drying of the cores is an outstanding feature of these stoves."

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Wednesday, November 13, 1940

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	£ s. d.
Electrolytic	62 0 0
High-grade fire-refined ..	61 10 0
Fire-refined of not less than 99.7 per cent.	61 0 0
Do., do., 99.2 per cent. ..	60 10 0
Black hot-rolled wire rods..	65 10 0

TIN

	£ s. d.
Standard cash	259 0 0
Three months	260 10 0
Settlement..	259 0 0
Official average Cash, Oct.	258 3 0 4/13
Do. Three Months, Oct.	260 10 3 3/13
Do. Settlement, Oct. ..	258 2 9 11/13

SPELTER*

	£ s. d.
G.O.B. (foreign) (duty paid)	25 15 0
Do. (domestic)	26 10 0
" Prime Western " ..	26 10 0
Refined and electrolytic ..	27 5 0
Not less than 99.99 per cent.	28 15 0

LEAD*

	£ s. d.
Good soft pig lead (foreign) (duty paid)	25 0 0
Do., do., (Empire and domestic)	25 0 0
English	26 10 0
Sheets, home	34 10 0
Do. export, f.o.b. ..	30 0 0
Pipes, home	34 0 0
Do. export, f.o.b. ..	30 10 0
Tea lead (nom.)	—

ALUMINIUM

Ingots	£110
Wire, 10g.	nom.
Sheets	nom.
Circles, 20/24g.	nom.

ZINC SHEETS, etc.

	£ s. d.
Sheets, 10g. and thicker, ex works..	39 2 6
Rolled zinc (boiler plates), ex works..	37 2 6
Zinc oxide (Red Seal), d/d buyers' premises ..	28 7 6

ANTIMONY

	£ s. d.
English, 99%, delivered ..	90 0 0
Foreign Regulus, duty paid .. 90 0 0 to	93 0 0
Chinese, prompt shipment, c.i.f. .. 78 0 0 to	82 0 0

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Quicksilver, ex-w'hse London 50 0 0 to 54 10 0

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	3s. 0d.
Finished bars, 18% tungsten	3s. 10d.
Finished bars, 22% tungsten	4s. 4d.

Per lb. d/d buyers' works.

NICKEL SILVER, etc.

	Per lb.
Ingots for raising ..	9d. to 1/3
Rolled—	
To 9 in. wide ..	1/3 to 1/9
To 12 in. wide ..	1/3½ to 1/9½
To 15 in. wide ..	1/3½ to 1/9½
To 18 in. wide ..	1/4 to 1/10
To 21 in. wide ..	1/4½ to 1/10½
To 25 in. wide ..	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/– to 1/8½
Wire round—	
to 10g.	1/6½ to 2/1½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/5½ upwards.

* Maximum prices per long ton delivered to buyers' premises.

FERRO-ALLOYS AND STEEL-MAKING METALS

(all prices nominal.)

	£ s. d.
Ferro-silicon (5-ton lots)—	
25%	18 10 0
45%	23 10 0
75%	36 10 0
Ferro-vanadium—	
35/50%	15/6 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free ..	6/– lb. Mo.
Ferro-titanium—	
20/25% carbon-free ..	1/9 lb.
Ferro-tungsten—	
80/85%	5/1 lb.
Tungsten metal powder—	
98/99%	5/2½ lb.
Ferro-chrome—	
2/4% car.	—
4/6% car.	47 0 0
6/8% car.	47 0 0
8/10% car.	—
Ferro-chrome—	
Max. 2% car.	—
Max. 1% car.	—
Max. 0.5% car... ..	—
70% carbon-free ..	—
Nickel—99.5/100%	£190 to £195
" F " nickel shot ..	175 0 0
Ferro-cobalt, 98/99% ..	8/9 lb.
Metallic chromium—	
96/98%	3/9 lb.
Ferro-manganese—	
76/80% loose	18 10 0
76/80% packed	20 0 0
Metallic manganese—	
94/96% carbon-free ..	1/9 lb.

Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.

SCRAP*

	£ s. d.	£ s. d.
SOUTH WALES—		
Short heavy steel, not ex. 24-in. lengths ..	3 16 6	to 3 19 0
Heavy machinery cast iron	4 6 6	
Ordinary heavy cast iron	4 1 6	
Cast-iron railway chairs	4 6 6	
Medium cast iron ..	3 17 9	
Light cast iron	3 13 0	
MIDDLESBROUGH—		
Short heavy steel	3 14	3 to 3 16 9
Heavy machinery cast iron	4 11 3	
Ordinary heavy cast iron	4 8 9	
Cast-iron railway chairs	4 8 9	
Medium cast iron ..	3 19 0	
Light cast iron	3 14 0	
BIRMINGHAM DISTRICT—		
Short heavy steel	3 9	3 to 3 11 9
Hematite ingot mould	5 10 9	
Heavy machinery cast iron	4 11 9	
Ordinary heavy cast iron	4 7 0	
Cast-iron railway chairs	4 7 0	
Medium cast iron ..	3 19 9	
Light cast iron	3 14 9	
SCOTLAND—		
Short heavy steel	3 14	0 to 3 16 6
Heavy machinery cast iron	4 13 9	
Ordinary heavy cast iron	4 8 9	
Cast-iron railway chairs	4 13 9	
Medium cast iron ..	3 16 9	
Light cast iron	3 11 9	

* Delivered free to consumers' works in England and Wales. For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less. All prices: Plus 2½ per cent. dealers' remuneration: 50 tons and upwards over three months 2s. 6d. extra.

PIG-IRON*

	£ s. d.
N.E. COAST (d/d Tees-side area)—	
Foundry No. 1	131/–
" No. 3	128/–
" No. 4	127/–
Forge No. 4	127/–
Hematite No. 1	138/6
Hematite M/Nos.	138/–
N.W. COAST—	
Hem. M/Nos. d/d Glasgow	138/6
" d/d Birmingham ..	150/–
MIDLANDS (d/d Birmingham dist.)—	
Staffs No. 4 forge	129/–
" No. 3 fdry.	130/–
Northants forge	126/6
" fdry. No. 3 ..	127/6
" fdry. No. 1 ..	130/6
Derbyshire forge	129/–
" fdry. No. 3 ..	130/–
" fdry. No. 1 ..	133/–
Phosphorus 0.5% to 0.75%	137/6
Phosphorus 0.1% to 0.5%	140/6
SCOTLAND—	
Foundry No. 1, Grangemouth	127/3
" No. 3, Grangemouth	124/9
Cleveland No. 3, Glasgow	131/–
" " Falkirk ..	128/–
Scottish hem. M/Nos. d/d..	138/6
SHEFFIELD (d/d district)—	
Derby forge	126/6
" fdry. No. 3 ..	127/6
Lincs forge	126/6
" fdry. No. 3 ..	127/6
W.C. hematite	144/–
LANCASHIRE (d/d eq. Man.)—	
Derby fdry. No. 3 ..	133/–
Staffs fdry. No. 3	133/–
Northants fdry. No. 3 ..	131/6
Cleveland fdry. No. 3 ..	133/–
Cylinder and Refined Irons	
North Zone..	174/–
South Zone..	176/6
Refined Malleable	
Birmingham and S. Staffs	171/6
Cold Blast	
South Staffs	220/6

* Prices of hematite and basic pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton under certain conditions.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.

	£ s. d.
BASIC:	
Soft, u.t., 100-ton lots ..	12 5 0
Tested, up to 0.25% C. ..	12 10 0
Tested, 0.25 to 0.33% C.	12 12 6
Tested, 0.33 to 0.41% C...	12 15 0
Hard (0.42 to 0.60% C.)..	13 17 6
" (0.61 to 0.85% C.)..	14 7 6
" (0.86 to 0.99% C.)..	14 17 6
" (1% C. and up) ..	15 7 6
Silico-manganese	16 5 0
Free-cutting	14 10 0
SIEMENS MARTIN ACID	
Up to 0.25% C.	15 15 0
Case-hardening	16 12 6
Silico-manganese	16 5 0

Billets, Blooms and Slabs for Forging and Stamping.

Basic soft, up to 0.25% C. ..	13 17 6
Basic hard, 0.41 to 0.60% C.	14 10 0
Acid, up to 0.25% C. ..	16 5 0

Other Semi-products, etc.

Tin bars	12 2 6
Sheet bars	12 2 6
*Wire rods, soft basic ..	17 7 6
" hard basic ..	21 2 6
" free-cutting ..	20 2 6
" acid	24 13 6

* Subject to rebate.

FINISHED STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.]

	£ s. d.
Plates, ship (N.E. Coast) ..	16 3 0
Boiler plts. (N.E. Coast) ..	17 0 6
Chequer plts. (N.E. Coast)	17 13 0
Angles, over 4 un. ins. ..	15 8 0
Tees, over 4 un. ins. ..	16 8 0
Joists, 3 in. × 3 in. and up	15 8 0
Rounds and squares, 3 in. to 5½ in.	16 8 0
Rounds under 3 in. to ⅜ in. (untested)	17 12 0
Flats—over 5 in. wide ..	15 13 0
" 5 in. wide and under ..	17 12 0
Rails, heavy, f.o.t. ..	14 10 6
Hoops	18 7 0
Black sheets, 24 g. (4 t. lots)	22 15 0
Galv. cor. shts. (")	26 2 6
Galv. flat shts. (")	26 12 6
Galv. fencing wire, 8g. plain	26 17 6

FINISHED IRON

	£ s. d.
CROWN IRON:	
England and Wales ..	15 12 6
Scotland	15 12 6
Ireland, f.o.q.	16 5 0
No. 3 BARS:	
England and Wales ..	12 10 0
Scotland	13 12 6
Ireland, f.o.q.	13 2 6
No. 4 BARS:	
England and Wales ..	13 0 0
Scotland	13 17 6
Ireland, f.o.q.	13 12 6
STRIP:	
England and Wales ..	17 0 0
STAFFS MARKED BARS, f.o.t...	—

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated, October 8, 1940.

	Dols.
No. 2 foundry, Phila.	24.84
No. 2 foundry, Valley	23.00
No. 2 foundry, Birm.	19.38
Basic, Valley	22.50
Malleable, Valley..	23.00
Grey forge, Valley	22.50
Ferro-mang., seaboard	120.00
O.-h. rails, h'y, at mill	40.00
Billets	34.00
Sheet bars	34.00
	Cents
Iron bars, Chicago	2.25
Steel bars	2.15
Tank plates	2.10
Beams, etc.	2.10
Wire rods	2.00
Skelp, grooved steel	1.90
Steel strip	2.10
Steel sheets	2.10
Sheets, galv., 24 g.	3.50
Wire nails	2.55
Plain wire	2.60
Tinplates, 100-lb. box	$5.00

COKE (at ovens)

Welsh foundry	45/– to 46/6
" furnace	34/– to 35/6
Durham foundry	42/–
" furnace	35/11
Scottish foundry	45/– to 50/–
" furnace	33/6 to 35/6

TINPLATES

f.o.b Bristol Channel ports

I.C. cokes	20 × 14 per box	30/– to 33/–
"	28 × 20 "	60/– to 66/–
"	20 × 10 "	43/– to 47/9
"	18¾ × 14 "	31/3 to 34/–
C.W.	20 × 14 "	.. 27/9
"	28 × 20 "	.. 55/6
"	20 × 10 "	40/– to 43/–
"	18¾ × 14 "	29/6 to 30/

NON-FERROUS SCRAP

(Official Maximum Prices, per ton ex Works.)

	£	s.	d.
Bright untinned copper wire, in crucible form or in hanks	57	10	0
No. 1 copper wire	57	0	0
No. 2 copper wire	55	10	0
Copper firebox plates, cut up	57	10	0
Clear untinned copper, cut up	56	10	0
Braziery copper	53	10	0
Q.F. process and shell-case brass, 70/30 quality, free from primers	49	0	0
Clean fired 303 S.A. cartridge cases	47	0	0
70/30 turnings, clean and baled	43	0	0
Brass swarf, clean, free from iron and commercially dry	34	10	0
New brass rod ends, 60/40 quality	38	10	0
Hot stampings and fuse metal, 60/40 quality	38	10	0
Admiralty gunmetal, 88-10-2, containing not more than ¼ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin	72	0	0

NEW BRASS TUBES, etc.

	Per lb.
Solid drawn tubes	13½d.
Brazed tubes	15½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	8½d.
Sheets to 10 w.g.	10½d.
Wire	10½d.
Rolled metal	9½d.
Yellow metal rods	8½d.

COPPER TUBES, etc.

Solid drawn tubes	14½d.
Brazed tubes	14½d.
Wire	9½d.

PHOSPHOR BRONZE

	Per lb. basis
Strip	13½d.
Sheet to 10 w.g.	13½d.
Wire	15½d.
Rods	15½d.
Tubes	20½d.
Castings	17d.

Delivery 3 cwt. free.
10% phos. cop. £35 above B.S.
15% phos. cop. £40 above B.S.
Phosphor tin (5%) £40 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.*

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 6	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 0	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	56 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 9	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 3½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	55 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	85 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	99 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	137 3
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 8½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 0½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 3
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	66 10½	65 0	73 2½
1928	65 0	65 0	65 6	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	65 9½
1929	66 0	66 9	67 0	68 1½	69 5	71 10½	72 9	72 6	72 6	72 6	72 6	72 6	70 4½
1930	72 6	72 6	70 0	67 6	67 6	67 6	67 6	64 6	63 6	63 6	63 6	63 6	66 11½
1931	59 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 7
1932	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6
1933	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6
1934	62 6	65 0	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	66 10½
1935	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	69 4½	70 0	67 10½
1936	70 0	70 0	70 0	70 0	70 0	70 0	75 0	75 0	75 0	75 0	75 0	81 0	73 0
1937	81 0	81 0	81 0	81 0	81 0	81 0	101 0	101 0	101 0	101 0	106 0	106 0	91 10
1938	109 0	109 0	109 0	109 0	109 0	109 0	109 0	109 0	109 0	109 0	109 0	109 0	109 0
1939	99 0	99 0	99 0	99 0	99 0	99 0	99 0	99 0	99 0	99 0	108 0	108 0	100 6
1940	108 6	111 0	111 0	111 0	111 0	111 0	120 0	120 0	120 0	120 0	—	—	—

* Delivered Middlesbrough area for years 1933 and onwards. Prior to 1933, prices were f.o.t. furnaces. NOTE: Prices have been subject to a rebate of 5/- per ton since November 1, 1937.

WILLIAM JACKS & COMPANY
LIMITED
WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG IRON

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY
LIMITED
CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2
ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS WANTED

EMPLOYMENT REGISTER.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

FOREMAN, experienced high duty and grey iron up to 26 tons, non-ferrous including aluminium and magnesium alloys, requires position. Accustomed mechanised foundries. (396)

EXPERIENCED IRONMOULDER seeks position as Foreman or Assistant. Accustomed light engineering, jobbing and repetition castings. Good technical training; willing to travel. (397)

FURNACE ATTENDANT, accustomed to metal mixing, cast iron and high-duty cast iron, seeks similar position with engineering foundry West Riding of Yorkshire district preferred. (398)

MACHINERY

WE WANT TO BUY

Secondhand

CRUDE OIL ENGINES. STEAM ENGINES. BOILERS. : PUMPS. ELECTRIC GENERATING SETS. : MOTORS. EXCAVATORS. LOCOMOTIVES. CRANES.

● *All are required for work of urgent National importance.*

If you have available any such plant, offer it to us without delay. We will either purchase outright or negotiate the sale on a commission basis.

GEORGE COHEN

SONS & CO., LTD. (Est. in the year 1834)

Wood Lane, LONDON, W.12. SHEpherds Bush 2070.
Stanningley Works, Nr. LEEDS. Stanningley 71171.
And at Birmingham, Sheffield, Manchester, Bristol, etc., etc.

WANTED.—Sandslinger.—Full particulars and price to GEORGE BLAIR & CO., LTD., Steelfounders, Gateshead, 8.

FOR SALE.—1-ton Foundry Crane Ladle, 4-ton Foundry Crane Ladle, 30-cwt. Foundry Crane Ladle, with worm tilting gear. —Apply E. HIND, LTD., South Bank/Tees.

THOS. W. WARD, LTD.

A.C. MOTORS, 400-450 VOLTS, 3 PHASE, 50 CYCLES.

500 h.p., 720 r.p.m., by Metro-Vickers; slip ring type.
500 h.p., 600 r.p.m., B.T.H.; slip ring type.
450 h.p., 600 r.p.m., B.T.H.; slip ring type.
55 h.p., 730-750 r.p.m., Drake & Gorman; slip ring type.

D.C. MOTORS, 200 to 250 VOLTS.

100 h.p., 220 volts, 977 r.p.m., B.T.H.; comp. wound.
70 h.p., 220 volts, 800-1,100 r.p.m., Electromotors; shunt wound.
65 h.p., 220 volts, 600 r.p.m., M. Hawkins; comp. wound.
60 h.p., 220 volts, 520 r.p.m., E.L.D.; comp. wound.

Write for "Albion" Catalogue.

ALBION WORKS, SHEFFIELD

'Grams: "Forward." 'Phone: 26311 (15 lines).

MACHINERY—*Continued*

PNEUMATIC MOULDING MACHINES

Macdonald Jolter, table 72 in. by 54 in.
Tabor ditto, table 27 in. by 20 in.
Tabor 21 in. by 16 in. squeeze.
Zimmerman Type R.P.W.2 Jolt Squeeze turnover, table 36 in. by 20 in.
Mumford Type (Jackman) Swing Headpress, 13 in. by 15 in. and 14 in. by 16 in.
Mumford Pneumatic Core Jolters having 15-in. by 20-in. and 12-in. by 12-in. tables.
Britannia No. 1 "Coventry" Pneumatic Turnover Jarr Ram, table 30 in. by 28 in.
50 Air Compressors; 500 Electric Motors, Dynamos, etc.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.
CROSSWELLS ROAD, LANGLEY,
Nr. Birmingham.
'Phone: Broadwell 1359.

SAND MIXERS AND AERATORS.—The "Breakir" Centrifugal Machine is *THE* machine. Outputs 10 cwts. to 8 tons per hr.—W. BREALEY & CO. LTD., Station Works, Ecclesfield, Sheffield.

FOR SALE.—One Junior Motive Type Sandslinger, built by the Foundry Plant & Machinery, Ltd., and only recently put into work. Travelling type with 7-tons sand bin with 12-ft. radius arm. The machine is complete and in first-class condition. Can be seen by appointment.—SIR JAMES FARMER NORTON & CO., LTD., Adelphi Iron Works, Salford 3, Manchester.

MISCELLANEOUS

WANTED.—Supplies of broken Plumbago Crucibles. State quantity and price.—Box 560, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

BILSTON FOUNDRIES. LIMITED, Highfields, Bilston, 'phone Bilston 41406, have still available a limited capacity for light castings work of national importance; could undertake approx. 25 tons per week, castings up to 3 cwts., first-class finish, sand-blasted, delivery and quality guaranteed. Immediate enquiries invited.

PATTERNS IN WOOD AND METAL for all branches of Engineering. Moulding methods carefully considered.—FURMSTON & LAWLOR, Letchworth.

'Phone: 22877 SLOUGH

TWO NEW Core blowers for bombs.
36" Cupola by Geo. Green.
48" Cupola by Constructional.
54" Cupola by Thwaites.
JOLT SQUEEZE "JACKMAN" MOULDING MACHINES, 14" x 16", as new. £90 each.
Morgan 250 lb. Tilting Furnace (Two).
Morgan 600 lb. Oilfired Tilter.
Lip Axis 800 lb. Oilfired Tilter.
NEW PIT FURNACES 150 lbs. capacity, oil or coke fired. £35 each.
NEW SHOTBLAST CABINET PLANTS with motor driven Exhaust Fans, complete, all sizes. Prompt delivery.

ALEX. HAMMOND, *Foundry Machinery Merchants.*
14, AUSTRALIA ROAD, SLOUGH
BUY FROM ME AND SAVE MONEY.

MAGNETIC SEPARATORS

"RAPID-BIAFLUX" *Patent*
PULLEY & DRUMS
The Popular
"OVERBAND"
FOR FOUNDRY SANDS
LISTED IN 5 SIZES

LIFTING MAGNETS
FOR PIG IRON & SCRAP
CLUTCHES & CHUCKS

THE RAPID MAGNETTING MACHINE Co., Ltd., Magnet Works, Lombard St., Birmingham, 12
'Phone: Victoria 1137-8 'Grams: "Borings, Birmingham."

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun and on occasions—be it admitted—of naughtiness.

Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman,
SCHOOL FOR THE BLIND
(Founded 1838).
SWISS COTTAGE, LONDON, N.W.3.